2. Subbasin Assessment – Water Quality Concerns and Status

Past land use practices combined with natural hydrology and fluvial geomorphology have resulted in water quality concerns within the Big Lost River watershed. Water quality monitoring has been scarce until recent years when overallocation of irrigation water combined with overutilization of public and private grazing lands has impinged upon the intent of the Federal Clean Water Act that waters of the United States be Fishable and Swimable. Water quality monitoring by the DEQ, and evaluation of water quality and fisheries data collected by other state and federal agencies has identified several waters in the Big Lost River watershed that are of concern with regard to water quality. Water quality concerns are directed toward compliance with numeric state water quality standards and beneficial uses of surface waters that include the effectiveness with which fish species are able to spawn and perpetuate their species as well as the population of other aquatic life related to the success of fisheries, particularly Salmonid Spawning and Cold Water Aquatic Life. Human safety with regard to direct (primary) contact with surface waters in the course of recreation can also be of concern where toxic substances and pathogens are involved.

2.1 Water Quality Limited Segments Occurring in the Subbasin

The Big Lost River subbasin has nine water quality limited segments that are included on the Idaho 1998 §303(d) list. Seven of the nine segments were brought forward from the 1996 §303(d) list. Two segments, Warm Springs Creek and Little Boone Creek were added by the DEQ in 1998 due to water quality concerns. The Beneficial Use Reconnaissance Program is conducted by the DEQ to evaluate water quality through the use of scores derived from sampling streams. The scores represent the quality of fish populations (SFI score), populations of aquatic macroinvertebrates (primarily insects) (score), and character of stream habitat that supports aquatic populations (SHI score). The scores for key BURP sites are shown in Appendix F. The scores are based on the second edition of the Water Body Assessment Guidance, a peer reviewed analytical tool to guide individuals through evaluation of surface water quality (DEQ 2002). Table 7 summarizes the §303(d) listed waters within the subbasin. Figure 64. shows the location of the §303(d) listed waters within the subbasin.

Table 7. §303(d) Segments in the Big Lost River Subbasin.

Waterbody Name	Segment ID Number	1998 §303(d)[1] Boundaries	Pollutants	Listing Basis
Big Lost River	2161	Moore Diversion to Hwy 20	Low Oxygen, Flow Alteration, Excess Nutrients, Excess Sediment, Elevated Temperature	Low SMI, SFI, and SHI scores
Big Lost River	2164	Chilly Buttes to Mackay Reservoir	Nutrients, Sediment	Low SMI, SFI, and SHI scores
Spring Creek	2167	Springs to Big Lost River	Dissolved Oxygen, Flow Alteration, Nutrients, Sediment, Temperature	Low SMI, SFI, and SHI scores
Antelope Creek	2168	Spring Creek to Big Lost River	Flow Alteration, Sediment, Temperature	Low SMI, SFI, and SHI scores
Twin Bridges Creek	2176	Headwaters to Big Lost River	Nutrients, Sediment	Low SMI, SFI, and SHI scores
East Fork Big Lost River	2179	Starhope Creek to Forks	Habitat Alteration	Low SMI, SFI, and SHI scores
East Fork Big Lost River	2180	Headwaters to Starhope Creek	Sediment, Temperature	Low SMI, SFI, and SHI scores
Little Boone Creek	5236	Headwaters to East Fork Big Lost River	Undetermined Pollutants	Low SMI, SFI, and SHI scores
Warm Springs Creek	5237	(Hamilton) Spring to Mackay Reservoir	Undetermined Pollutants	Low SMI, SFI, and SHI scores

[1]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

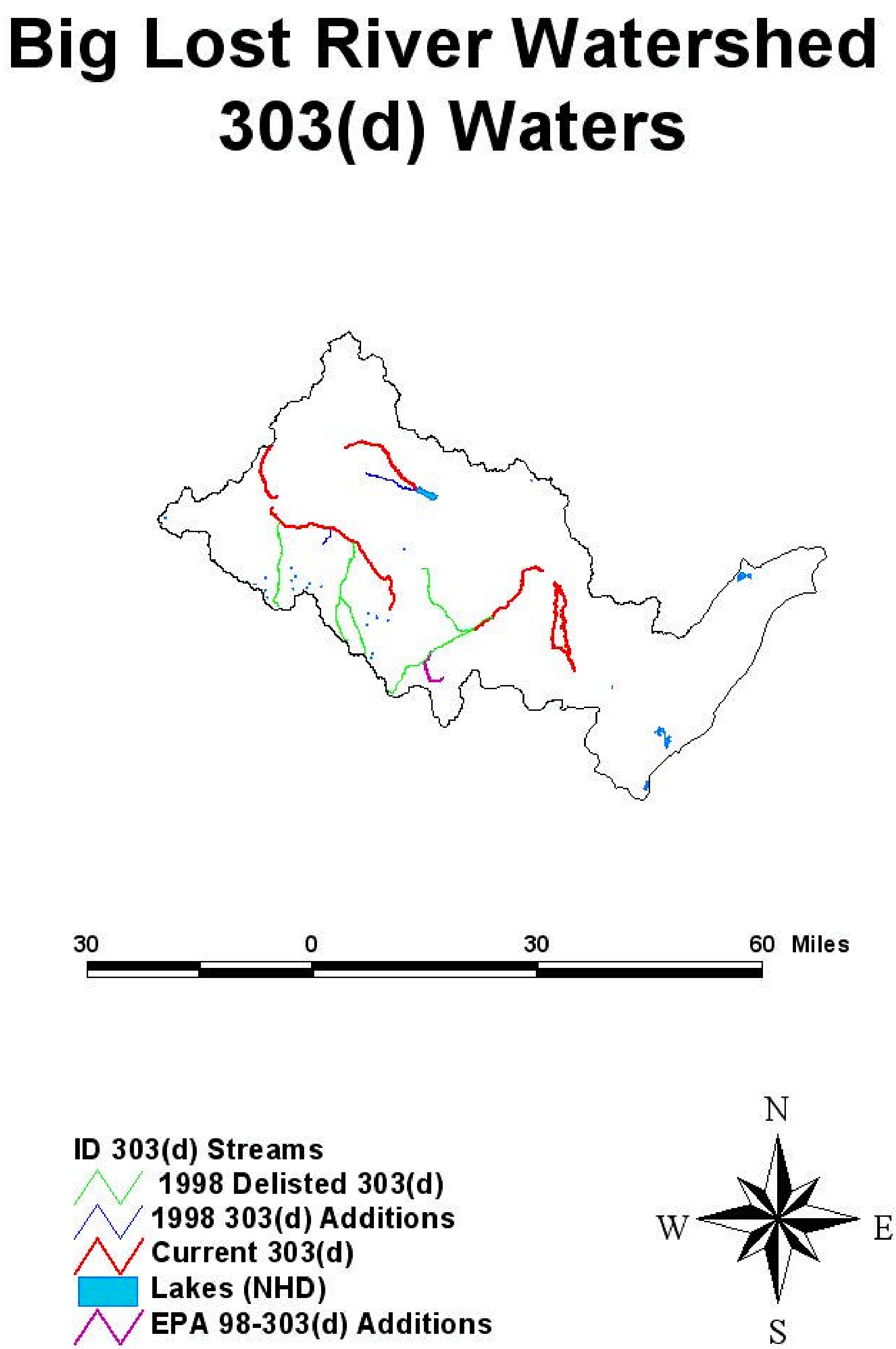

Figure 64. Big Lost River Watershed §303(d) listed Waters.

2.2 Applicable Water Quality Standards

Idaho water quality standards are published in Idaho's rules at IDAPA 58.01.02. They require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). Beneficial uses (BU) are the characteristics of Idaho's streams to be utilized for various purposes, and support status is defined at IDAPA58.01.02.053. The Water Body Assessment Guidance, second edition (Grafe et al. 2002) gives a more detailed description of the procedure for assessing beneficial uses. Beneficial uses are categorized as existing uses, designated uses, and presumed uses. See appendix C applicable water quality standards in their entirety.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and "presumed" uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water could support salmonid spawning, but salmonid spawning is not yet occurring.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each waterbody or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include cold water aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for waterbodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses.) Table 8 identifies the designated uses for waterbodies in the Big Lost River subbasin.

Table 8. Big Lost River subbasin designated beneficial uses.

Waterbody	Water Body Unit (WBID)	Boundaries	Designated Uses[1]	1998 §303(d) List[2]
Big Lost River	US-1	Sinks (playas) and Dry Channel	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-2	Spring Creek to Big Lost River Sinks (playas)	CW,SS,PCR,DWS, SRW	Yes
Big Lost River	US-4	Antelope Creek to Spring Creek	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-7	Alder Creek to Antelope Creek	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-10	Beck and Evan Ditch to Alder Creek	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-11	Mackay Reservoir Dam to Beck and Evan Ditch	CW,SS,PCR,DWS, SRW	No
Mackay Reservoir	US-12	Mackay Reservoir	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-13	Jones Creek to Mackay Reservoir	CW,SS,PCR,DWS, SRW	Yes
Big Lost River	US-15	Thousand Springs Creek to Jones Creek	CW,SS,PCR,DWS, SRW	Yes
Big Lost River	US-24	Burnt Creek to Thousand Springs Creek	CW,SS,PCR,DWS, SRW	No
Big Lost River	US-25	Summit Creek to and including Burnt Creek	CW,SS,PCR,DWS, SRW	No

[1]CW – Cold Water Aquatic Life, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply, SRW – Special Resource Water.

[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Presumed Uses

In Idaho, most waterbodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called “presumed uses,” DEQ will apply the numeric criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water is not found to be an existing use, an use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria. (IDAPA 58.01.02.101.01). Table 9 identifies the presumed uses for waterbodies in the Big Lost River subbasin.

Table 9. Big Lost River subbasin existing/presumed beneficial uses.

Waterbody	Water Body Unit (WBID)	Boundaries	Existing/Presumed Uses[1]	1998 §303(d) List[2]
Spring Creek	US-3	Lower Pass Creek to Big Lost River	CW and PCR or SCR	Yes
King, Lime Kiln, Ramshorn, and Anderson Canyon Creek	US-5	Source to Mouth	CW and PCR or SCR	No
Lower Pass Creek	US-6	Source to Mouth	CW and PCR or SCR	No
Elbow, Jepson, Clark, Maddock, and Jaggles Canyon Creek	US-8	Source to Mouth	CW and PCR or SCR	No
Pass Creek	US-9	Source to Mouth	CW and PCR or SCR	No
Jones Creek	US-14	Source to Mouth	CW and PCR or SCR	No
Thousand Springs Creek	US-16	Source to Mouth	CW and PCR or SCR	No
Lone Cedar Creek	US-17	Source to Mouth	CW and PCR or SCR	No
Cedar Creek	US-18	Source to Mouth	CW and PCR or SCR	No
Rock Creek	US-19	Source to Mouth	CW and PCR or SCR	No
Willow Creek	US-20	Source to Mouth	CW and PCR or SCR	No

Arentson Gulch and Unnamed Tributaries	US-21	Source to Mouth	CW and PCR or SCR	No
Sage Creek	US-22	Source to Mouth	CW and PCR or SCR	No
Parsons Creek	US-23	Point of perennial flow north of road to Mackay Reservoir	CW and PCR or SCR	No
Twin Bridges Creek	US-26	Source to Mouth	CW and PCR or SCR	No
North Fork Big Lost River	US-27	Source to Mouth	CW and PCR or SCR	No
Summit Creek	US-28	Source to Mouth	CW and PCR or SCR	No
Kane Creek	US-29	Source to Mouth	CW and PCR or SCR	No
Wildhorse Creek	US-30	Fall Creek to Mouth	CW and PCR or SCR	No
Wildhorse Creek	US-31	Source to Mouth	CW and PCR or SCR	No
Fall Creek	US-32	Source to Mouth	CW and PCR or SCR	No
East Fork Big Lost River	US-33	Cabin Creek to Mouth	CW and PCR or SCR	Yes
Fox Creek	US-34	Source to Mouth	CW and PCR or SCR	No
Star Hope Creek	US-35	Lake Creek to Mouth	CW and PCR or SCR	No
Star Hope Creek	US-36	Source to Lake Creek	CW and PCR or SCR	No
Muldoon Canyon Creek	US-37	Source to Mouth	CW and PCR or SCR	No
Lake Creek	US-38	Source to Mouth	CW and PCR or SCR	No
East Fork Big Lost River	US-39	Source to Cabin Creek	CW and PCR or SCR	Yes
Cabin Creek	US-40	Source to Mouth	CW and PCR or SCR	No
Corral Creek	US-41	Source to Mouth	CW and PCR or SCR	No
Boone Creek	US-42	Source to Mouth	CW and PCR or SCR	No
Warm Springs Creek	US-43	Source to Mouth	CW and PCR or SCR	Yes
Navarre Creek	US-44	Source to Mouth	CW and PCR or SCR	No
Alder Creek	US-45	Source to Mouth	CW and PCR or SCR	No
Antelope Creek	US-46	Spring Creek to Mouth	CW and PCR or SCR	Yes
Antelope Creek	US-47	Dry Fork Creek to Spring Creek	CW and PCR or SCR	No
Spring Creek	US-48	Source to Mouth	CW and PCR or SCR	No
Cherry Creek	US-49	Confluence of Left Fork Cherry and Lupine Creeks to Mouth	CW and PCR or SCR	No

Lupine Creek	US-50	Source to Mouth	CW and PCR or SCR	No
Left Fork Cherry Creek	US-51	Source to Mouth	CW and PCR or SCR	No
Antelope Creek	US-52	Iron Bog creek to Dry Fork Creek	CW and PCR or SCR	No
Bear Creek	US-53	Source to Mouth	CW and PCR or SCR	No
Iron Bog Creek	US-54	Confluence of Left and Right Fork Iron Bog Creek to Mouth	CW and PCR or SCR	No
Right Fork Iron Bog Creek	US-55	Source to Mouth	CW and PCR or SCR	No
Left Fork Iron Bog Creek	US-56	Source to Mouth	CW and PCR or SCR	No
Antelope Creek	US-57	Source to Iron Bog Creek	CW and PCR or SCR	No
Leadbelt Creek	US-58	Source to Mouth	CW and PCR or SCR	No
Dry Fork Creek	US-59	Source to Mouth	CW and PCR or SCR	No
South Fork Antelope Creek	US-60	Antelope Creek to Mouth	CW and PCR or SCR	No
Hammond Spring Creek Complex	US-61	Spring Complex	CW and PCR or SCR	No

[1]CW – Cold Water, SS – Salmonid Spawning, PCR – Primary Contact Recreation, SCR – Secondary Contact Recreation, AWS – Agricultural Water Supply, DWS – Domestic Water Supply, SRW – Special Resource Water.
[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

2.3 Summary and Analysis of Existing Water Quality Data

Data related to water quality in the Big Lost River watershed is sporadic and scant with regard to tributaries and much of the mainstem flow. Land management agencies have collected the majority of data, outside of DEQ's efforts, and that data primarily relates to water temperature and fish presence. Fish abundance data is available for a number of locations. Historic for comparison is limited to anecdotal accounts that have been reviewed in the Fisheries section of this report. Water column data has been collected by USGS at one location near the Howell Ranch but has limited application to determining trends due to frequency of sampling and parameters sampled. Idaho State University has conducted studies to evaluate sampling techniques in lotic (flowing) systems. Riparian habitat monitoring has been conducted at several locations by the Forest Service within the watershed, however this data has limited use to determine past or existing water quality conditions because it has never been assimilated by the agency or applied to any form of land management or effectiveness monitoring. The BLM has contributed some flow measurements on tributary streams that have been included in the Subwatershed Description section of this report. DEQ has conducted BURP monitoring throughout the watershed. Erosion inventory and substrate sediment evaluation has been done on several listed streams and their tributaries.

Flow Characteristics

The temporal and spatial distribution of flow in the Big Lost watershed has been a defining characteristic of human use and natural conditions in the watershed. Flow here is related to climate, like most of the watersheds in the region, however geology, and particularly geomorphology has the most influence. During years of average or above average precipitation streams are often dry for a significant portion of the year because their flow seeps in to the substrate (infiltration). The alluvial substrate in much of the Big Lost River valley is thousands of feet deep in places and rapidly absorbs huge volumes of flow. This characteristic is difficult to see in any statistical analysis of flow, however, in the process of water quality monitoring and direct observations in the watershed it has been observed where streams are dry and for what seasons of the year. This information has been included into this report in subwatershed descriptions and summaries.

As part of the analysis of Big Lost River flow, data recurrence intervals were established to show the frequency of various peak flow rates over time. Streams that have proper channel dimension, pattern, and profile in watersheds at this latitude generally experience bankfull conditions at a rate of about every 1.7 years or less. Bankfull flow is important because it is the flow that sediment is transported most efficiently within the stream channel and subsequently within the network of streams that comprise the watershed. Bankfull flow is also the event that erodes streambanks at the highest rate of the season. This erosion is greatly accelerated if streambank stability has been reduced by management activities related to land use (Rosgen 1996).

The 1.5 year recurrence interval flow from measurements at the Howell Ranch (USGS Site #13120500), the upper-most gage on the Big Lost River, is 1700 cfs (Figure 65). Streams that are changing channel dimension or are loosing flow to infiltration or diversion would experience bankfull conditions at an increasing interval related to the extent of flow loss. Additionally the 1.5-year recurrence flow would be less. This is because greater flow would be required to achieve bankfull flow in a channel with increasing volume and less flow would be available from year to year. Additionally, since recurrence intervals are based on peak flow they give no information on how long streams are dry. The USGS has placed flow gages for the purpose of measuring flow, not dryness. To place a gage at a location where the stream channel is dry would not be a good use of resources. The river reach from the Howell Ranch gage to the channel just above Mackay Reservoir is generally dry. Some stream flow accrues just above the reservoir from groundwater seepage back into the channel. This is strongly related to groundwater levels. Ground water levels are related to inflow from other streams as well as removal by ground water pumping for irrigation.

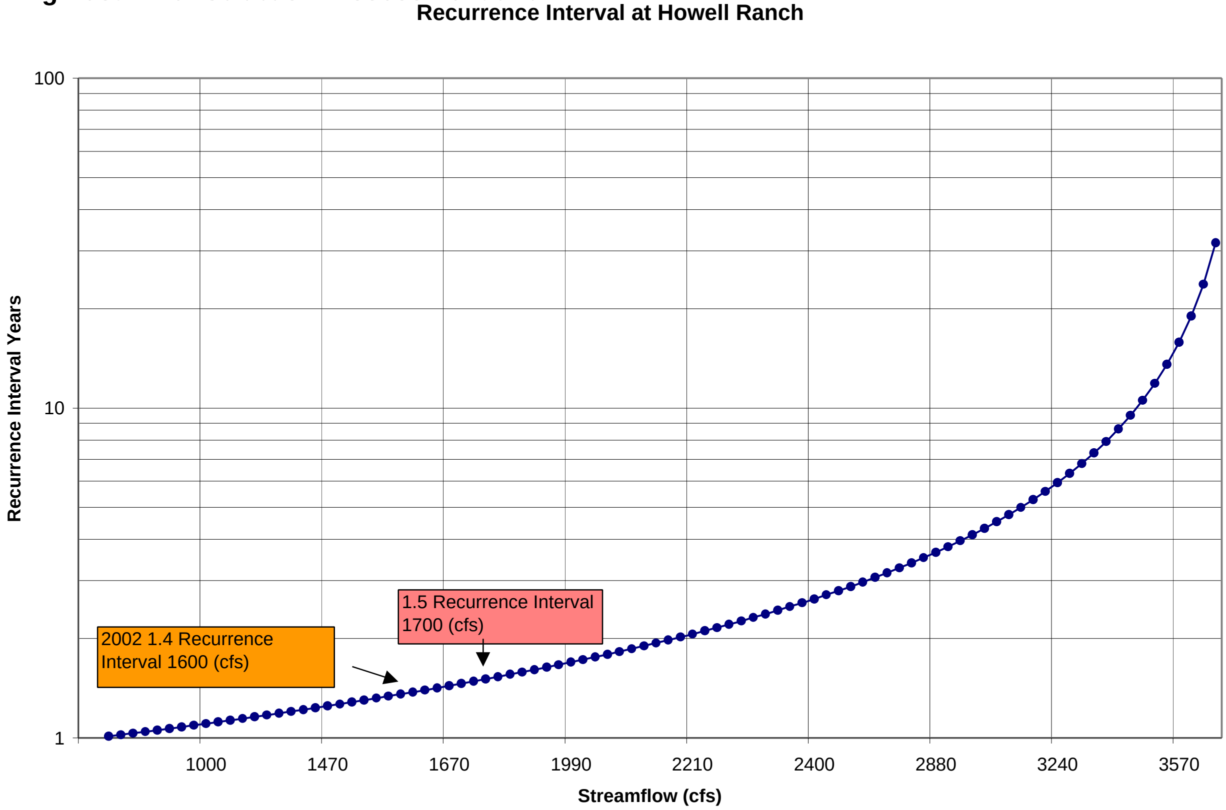

Figure 65. Peak flow recurrence interval for the Big Lost River at the Howell Ranch.

The 1.5-year recurrence interval flow from the gage just above Mackay Reservoir Ranch (USGS Site #13123500) is 597 cfs (Figure 66). It is markedly less than the upstream estimate for the Howell Ranch.

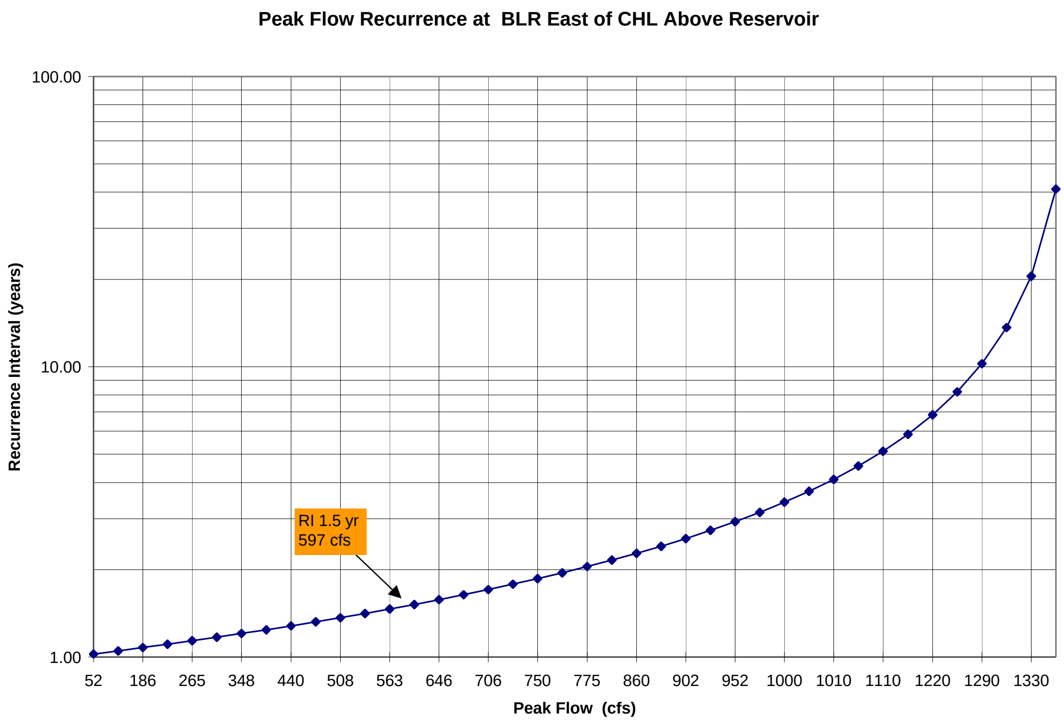

Figure 66 Peak flow recurrence interval for the Big Lost River above Mackay Reservoir.

The 1.5 year recurrence interval flow from measurements at the gage below Mackay Reservoir (USGS Site #13127000) is 1,120 cfs (Figure 67). This peak flow recurrence is influenced by the reservoir and is a function of demand for irrigation water. Much of the inflow and storage water in Mackay Reservoir is derived from Warm Springs Creek. Spring Creeks typically exhibit a much more consistent flow pattern than that of streams with hydrologic curves driven by snowmelt and storm events and recurrence interval is not as meaningful.

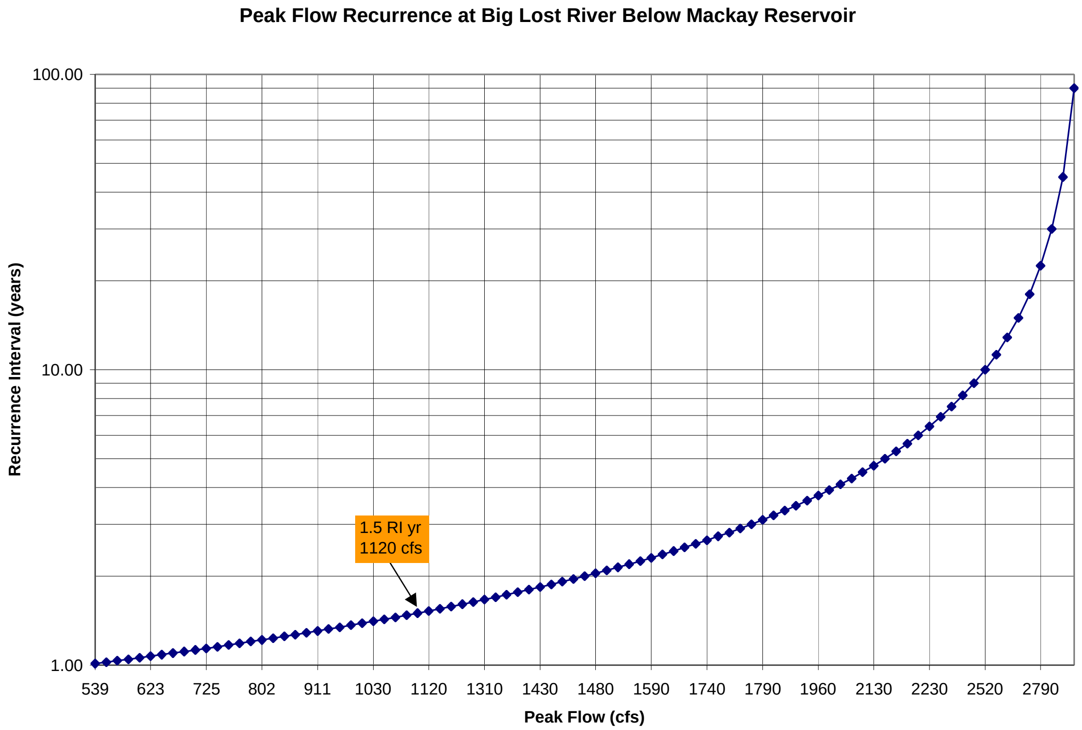

Figure 67. Peak flow recurrence interval for the Big Lost River below Mackay Reservoir.

Peak flow is shown for the Howell Ranch in Figure 68. and mean monthly Flow is shown in Figure 69. The frequency and magnitude of peak flow can be seen from 1904 to 2002, the years that the gage has been in operation. Mean monthly flow is averaged from data of the same period.

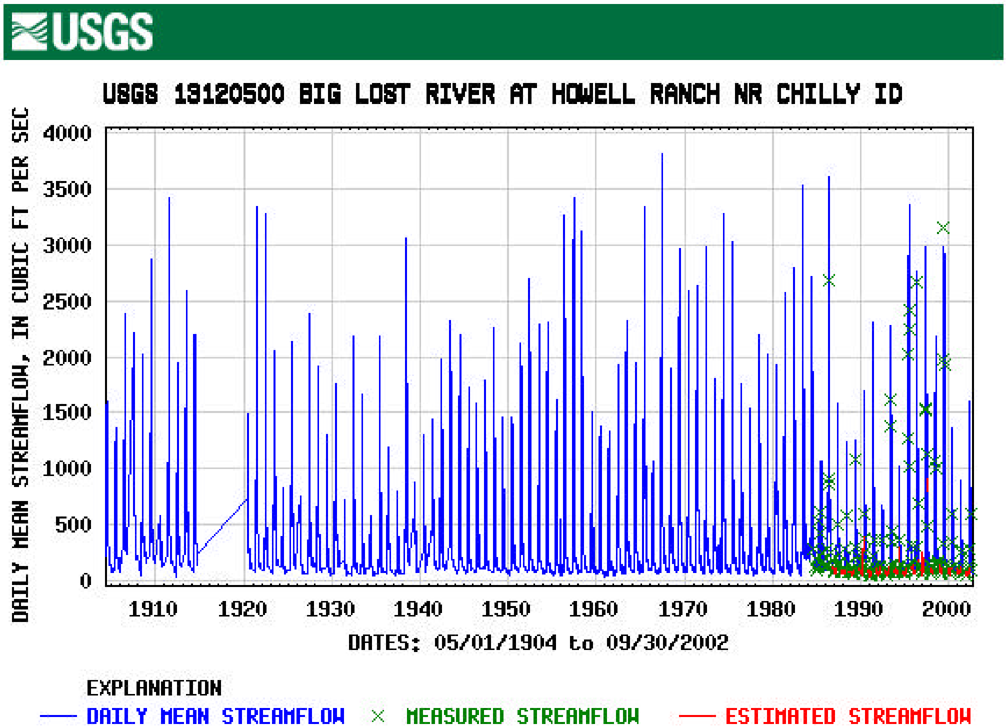

Figure 68 Peak flow of the Big Lost River measured at the Howell Ranch USGS gage (USGS, http://water.usgs.gov/nsip/) .

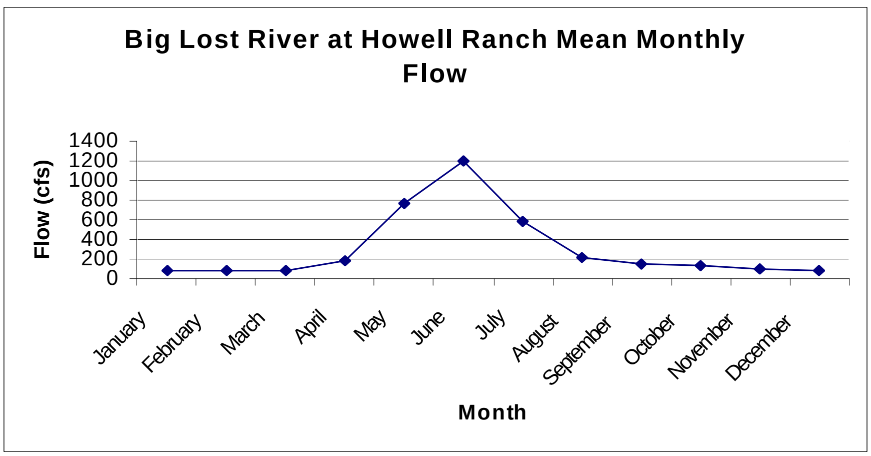

Figure 69. Mean monthly flow of the Big Lost River measured at the Howell Ranch gage.

Peak flow for the USGS gage above Mackay Reservoir is shown in Figure 70. and mean monthly flow is shown in Figure 71. The frequency and magnitude of peak flow can be seen from 1919 to 1959, the years that the gage has been in operation. Mean monthly flow is averaged from data of the same period. Annual intervals of zero flow are apparent.

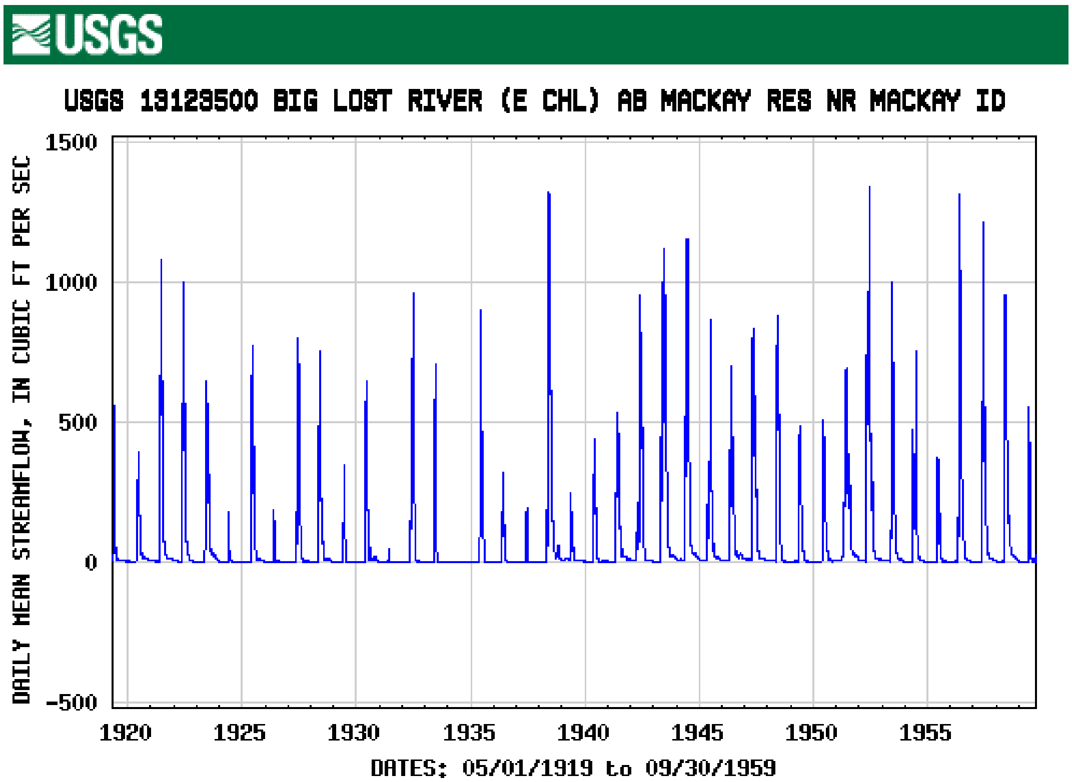

Figure 70 Peak flow of the Big Lost River measured above Mackay Reservoir (USGS, http://water.usgs.gov/nsip/).

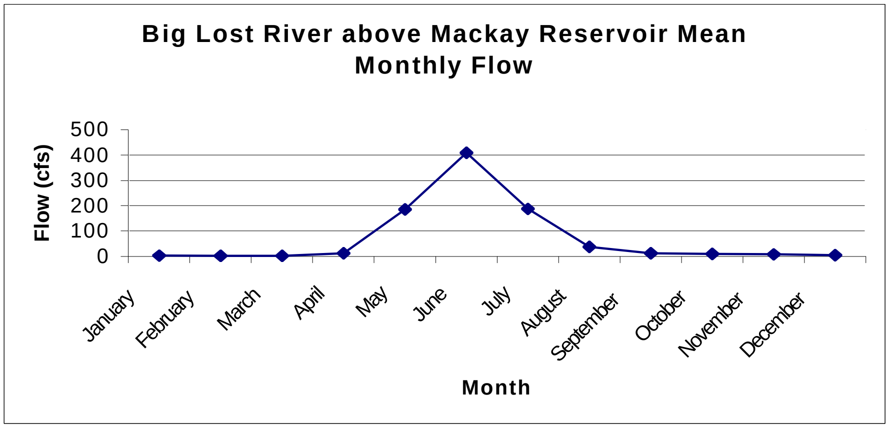

Figure 71. Mean monthly flow of the Big Lost River measured above Mackay Reservoir.

Peak flow for the USGS gage below Mackay Reservoir is shown in Figure 72. and mean monthly flow is shown in Figure 73. The frequency and magnitude of peak flow can be seen from 1903 to 2002, the years that the gage has been in operation. Mean monthly flow is averaged from data of the same period.

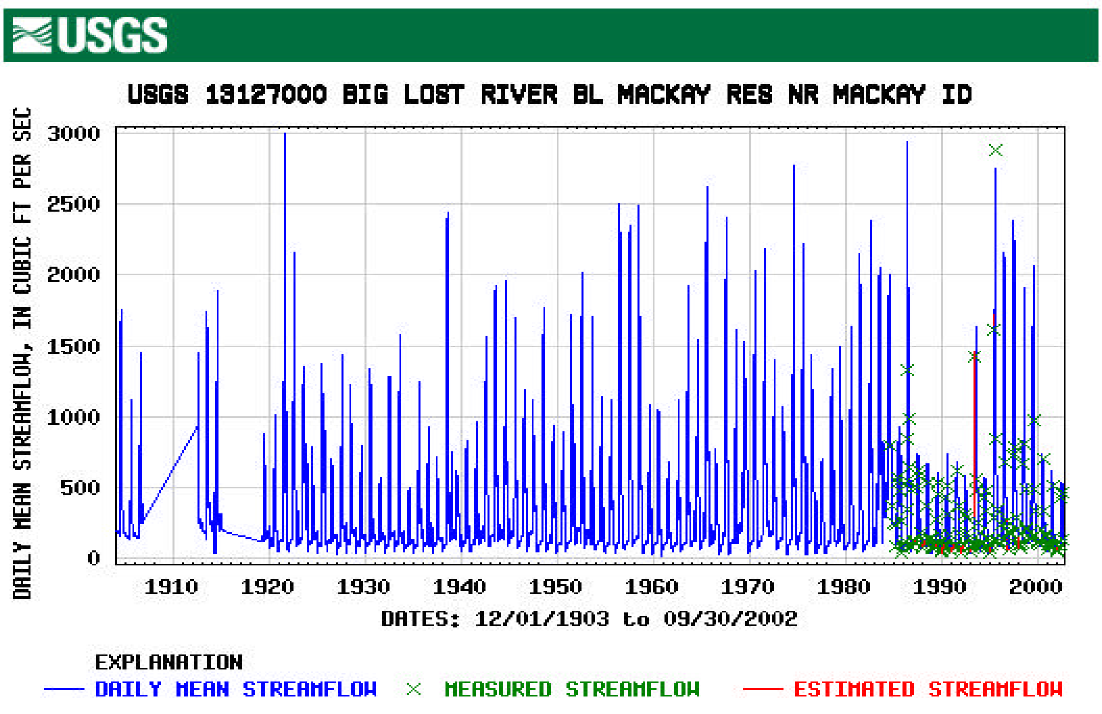

Figure 72. Peak flow of the Big Lost River measured below Mackay Reservoir(USGS, http://water.usgs.gov/nsip/).

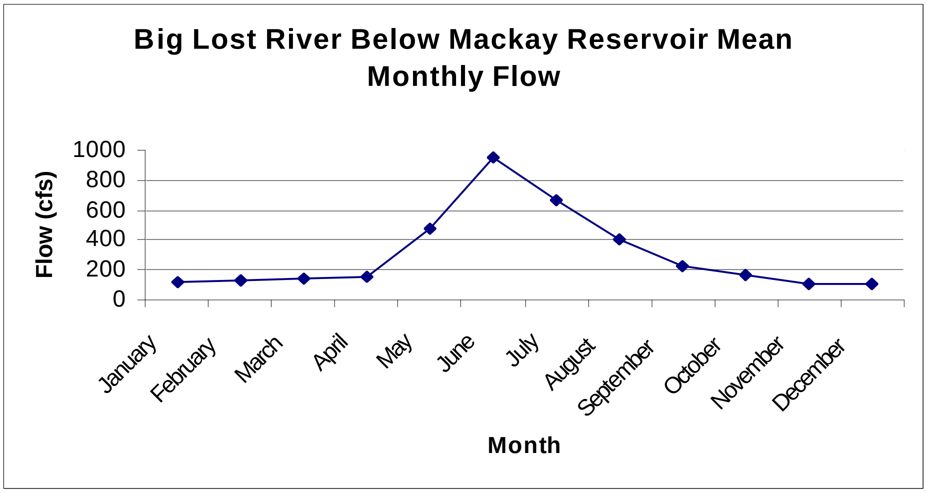

Figure 73. Mean monthly flow of the Big Lost River measured below Mackay Reservoir.

Peak flow for Warm Springs Creek at the USGS gages(USGS Site #13124500 east channel,#13125000 west channel) above Mackay Reservoir is shown in Figure 74 and Figure 75. and mean monthly flow is shown in Figure 76. Gages were located on two split channels. The frequency and magnitude of peak flow can be seen from 1919 to 1959, the years that the gages were in operation. Combined mean monthly flow is averaged from data of the same period.

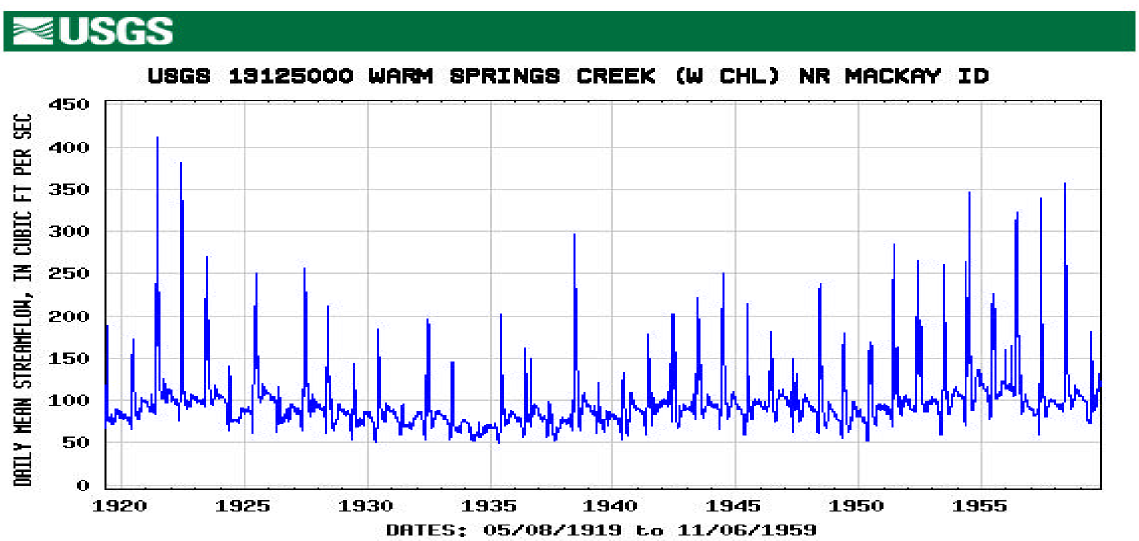

Figure 74. Peak Flow of west channel gage on Warm Springs Creek (USGS, http://water.usgs.gov/nsip/).

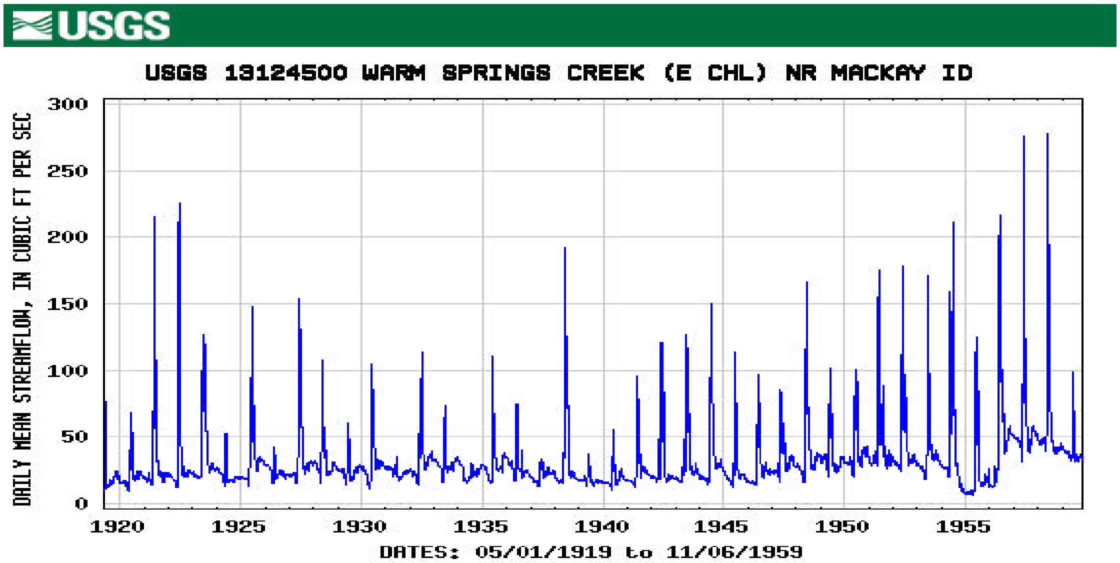

Figure 75. Peak Flow of east channel gage on Warm Springs Creek (USGS, http://water.usgs.gov/nsip/) .

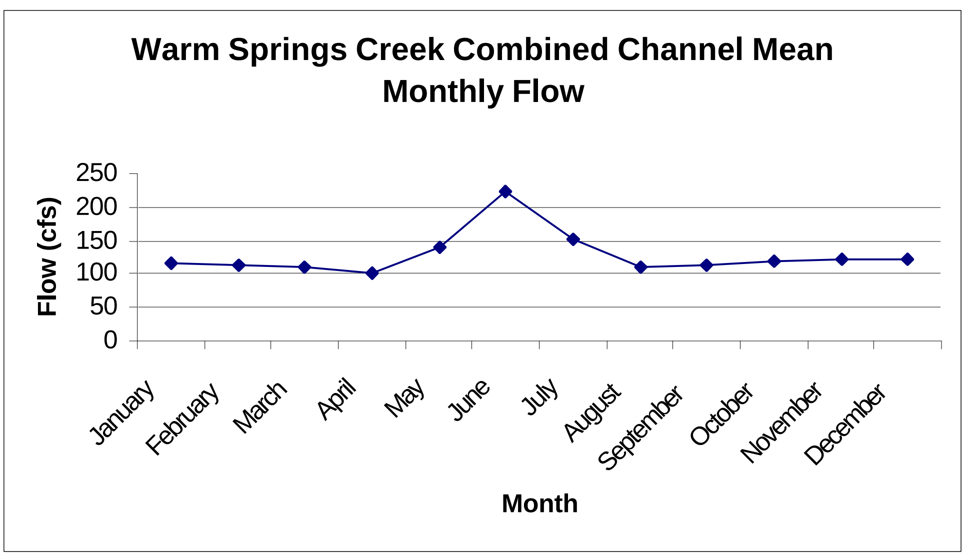

Figure 76. Combined channel mean monthly flow in Warm Springs Creek.

<u>Water Column Data</u>

Temperature data has been collected with increased intensity by the Forest Service since 1999 when meetings were held to discuss the future development of the Big Lost River Subbasin Assessment and TMDL. DEQ has also conducted temperature monitoring at several locations on

303(d) listed streams. Data was collected using submersible data loggers with the emphasis placed on locations just above the mouths of streams for analysis.

Streams temperature data was summarized according to cold water aquatic life criteria periods from June 22nd to September 21st for exceedence of criteria (not greater than 22ºC instantaneous and daily average not greater than 19ºC). Streams temperature regime was also summarized according to salmonid spawning criteria (not greater than 13ºC instantaneous and daily average not greater than 9ºC). Salmonid spawning periods used for temperature evaluation were March 15th through June 30th for spring spawning cutthroat and rainbow trout and September 15th through November 15th for fall spawning brook trout. Temperature was collected at two hour intervals for varying periods depending upon deployment timing, when flow ceased, or when data was corrupted by other means, undetermined, but reflected in the data.

In addition to in-stream temperature monitoring DEQ contracted IRZ consulting of Hermiston, Oregon to conduct paired color infrared and thermal infrared imaging and analysis for select streams in the Big Lost River watershed. Flights were made on September 4th of 2002 and in the early part of the day when waters were relatively cool and again in the afternoon on the Big Lost River above Chilly Buttes, including the East Fork of the Big Lost River. Other sections of the Big Lost River below Chilly Buttes were dry. Other streams were flown one time in the afternoon to evaluate temperature loading. Single flight streams were Alder Creek, Antelope Creek, and the North Fork of the Big Lost River. Cherry Creek and Sage Creek were scheduled to be flown but were dry at the time the flights were to have taken place. This data will be used primarily for implementation of BMPs since it was not available in adequate time to direct sample loacations in 2003.

Water column data was collected during two 1996 and 1999 from May through September at the Howell Ranch on the Big Lost River at Chilly Buttes. This sampling was a part of routing monitoring affiliated with the gage station there. Data that pertains to water quality parameters important to aquatic life were summarized. DEQ collected water column data above and below a tailings pile affiliated with the Empire Mine on the Big Lost River to evaluate metals loading.

Stream Temperature Data

Temperature data is displayed from headwaters sections of the Big Lost River and their tributaries downstream in Table 10 through 31. Temperature is considered in exceedence of water quality criteria if 10% or more of the measurements are above the particular water quality criteria under consideration. A minimum of two measurements must be collected for evaluation to determine if criteria are exceeded. Each criteria exceedance is highlighted in yellow and bold print. Spawning exceedence is based on number of days evaluated between March 15 and June 30 for spring spawning and September 15 to November 15 for Fall Spawning, Cold water aquatic life criteria is evaluated from June 22 – September 21. Temperature data for the East Fork of the Big Lost River is summarized in Table 10 and 11 from upstream locations to downstream sample sites. Data was collected from 1999 through 2000.

Table 10. East Fork Big Lost temperature data and number of days where water temperatures exceeded the cold water aquatic life water quality standards.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over (%)**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
East Fork Above Guard Station	07/11/02-10/08/02	90	2 (2%)	22.4	7/11/02	0	13.8	7/14/03
East Fork at Burma Bridge	6/29/02-10/06/02	100	8 (8%)	23.6	7/11/02	0	16.9	7/15/03
East Fork Above Exclosure	6/9/99-10/19/99	132	0	18.8	7/13/99	0	13.4	7/7/99
East Fork Above Exclosure	5/24/00-10/10/00	132	0	20.2	7/29/00	0	12.9	8/2/00
Above Starhope	6/14/01-10/16/01	125	4 (3%)	22.5	7/2/01	0	16.2	7/6/01
Above Starhope	7/11/02-10/8/02	90	2 (2%)	22.4	7/11/02	0	13.8	7/14/02
Above Wildhorse	6/10/99-10/18/99	131	0	19.0	8/24/99	0	13.6	8/24/99
Above Wildhorse	5/25/00-10/3/00	132	0	19.4	8/11/00	0	15.1	8/11/00
Above Wildhorse	6/15/01-10/25/01	133	0	20.2	8/6/01	0	16.0	7/5/01
Above Wildhorse	7/3/02-10/2/02	92	1 (1%)	22.0	7/11/02	0	16.7	7/15/02
Above North Fork	7/13/03-9/24/03	74	0	20.2	8/14/03	0	15.6	7/25/03

Table 11. East Fork Big Lost Temperature data and number of days where water temperatures exceeded the salmonid spawning water quality standards.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
East Fork Above Guard Station	07/11/02-10/08/02 (Fall)	24	**8 (33%)**	14.8	9/19/02	2 (8%)	9.27	9/16/02
East Fork at Burma Bridge	6/29/02-10/06/02 (Fall)	22	**8 (36%)**	15.4	9/15/02	2 (9%)	9.9	9/15/02
East Fork Above Exclosure	6/10/99-10/19/99 (Spring)	21	**21 (100%)**	18.1	6/20/99	**20 (95%)**	11.2	6/24/99
East Fork Above Exclosure	6/10/99-10/19/99 (Fall)	35	**7 (20%)**	14.3	9/15/99	**6 (17%)**	9.6	9/15 &24/99
East Fork Above Exclosure	5/24/00-10/10/00 (Spring)	38	**34 (89%)**	19.4	6/28/00	**35 (95%)**	12.4	6/28/00
East Fork Above Exclosure	5/24/00-10/10/00 (Fall)	26	**6 (23%)**	15.6	9/15 &16/00	**4 (21%)**	10.3	9/15 &16/00
Above Starhope	6/14/01-10/16/01 (Spring)	17	**17 (100%)**	21.3	6/21/01	**16 (94%)**	15.2	6/29/01
Above Starhope	6/14/01-10/16/01 (Fall)	32	2 (6%)	13.7	9/24/01	**11 (34%)**	10.15	9/24/01
Above Starhope	7/11/02-10/802 (Fall)	24	**8 (33%)**	14.8	9/19/02	2 (8%)	9.27	9/16/02
Above Wildhorse	6/10/99-10/18/99 (Spring)	21	**4 (19%)**	13.7	6/20/99	**11 (52%)**	9.74	6/20/99
Above Wildhorse	6/10/99-10/18/99 (Fall)	34	**11 (32%)**	14.5	9/16/99	**10 (29%)**	10.0	9/24/99

Above Wildhorse	5/25/00-10/3/00 (Spring)	37	**23 (62%)**	16.7	6/28-30-01	**29 (78%)**	13.35	6/30/00
Above Wildhorse	5/25/00-10/3/00 (Fall)	19	**6 (32%)**	16.3	9/15-16/00	**8 (42%)**	12.1	9/16/00
Above Wildhorse	6/15/01-10/25/01 (Spring)	16	**16 (100%)**	19.8	6/29/01	**16 (100%)**	14.9	6/29/01
Above Wildhorse	6/15/01-10/25/01 (Fall)	41	**10 (24%)**	14.4	9/24/01	**16 (39%)**	10.7	9/24/01
Above Wildhorse	7/3/02-10/2/02 (Fall)	18	**2 (11%)**	13.98	9/15/02	**8 (44%)**	11.04	9/15/02
Above North Fork Big Lost River	7/13/03-9/24/03 (Fall)	10	**2 (20%)**	13.3	9/22-23/03	0 (0%)	8.57	9/22/03

There was no exceedence of cold water aquatic life criteria noted at sites evaluated on the East Fork, though exceedence of salmonid spawning criteria were numerous. The number and percent of days in exceedence are highlighted in yellow (total days greater than 10% of days evaluated).

Temperature data for Corral Creek is summarized in Table 12 and 13. Corral Creek is the most upstream tributary monitored with perennial flow. Data was collected in 1999 and 2000 by the Forest Service.

Table 12. Corral Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Corral Creek above East Fork	6/10/99-10/19/99	132	0	20.1	7/13/99	0	15.0	7/13/99
Corral Creek above East Fork	5/25/00-10/3/00	132	1 (1%)	22.4	7/29/00	0	15.1	7/2/00

Table 13. Corral Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Corral Creek above East Fork	6/10/99-10/19/99 (Spring)	21	**20 (95%)**	16.86	6/20/99	**20 (95%)**	12.15	6/24/99
Corral Creek above East Fork	6/10/99-10/19/99 (Fall)	35	**6 (17%)**	13.25	9/21/99	**4 (11%)**	9.33	9/24/99
Corral Creek above East Fork	5/25/00-10/3/00 (Spring)	37	**34 (92%)**	21.7	6/28/00	**37 (100%)**	14.39	6/29/00
Corral Creek above East Fork	5/25/00-10/3/00 (Fall)	19	**6 (32%)**	17.1	9/16/00	**5 (26%)**	11.44	9/16/00

There was no exceedence of cold water aquatic life criteria noted in Corral Creek above the East Fork of the Big Lost River. Exceedence of salmonid spawning criteria occurred at the monitoring location in both monitoring years for spring and fall spawning periods.

Temperature data for Star Hope Creek is summarized in Table 14 and 15. Star Hope Creek is the most voluminous tributary to the East Fork of the Big Lost River. Data was collected in 2001 by the Forest Service and in 2002 by DEQ.

Table 14. Temperature data and number of days where water temperatures exceeded the cold water aquatic life water criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over (%)**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Starhope above East Fork	6/13/01-10/25/01	135	0	21.3	7/26/01	0	14.9	7/5/01
Starhope above East Fork	6/28/02-10/6/02	101	10 (10%)	26.9	7/15/02	0	16.0	7/12/02

Table 15. Temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Starhope above East Fork	6/13/01-10/25/01 (Spring)	18	**18 (100%)**	20.6	6/13/01	**17 (94%)**	13.6	6/29/01
Starhope above East Fork	6/13/01-10/25/01 (Fall)	41	**17 (41%)**	16.4	9/23-24/01	**11 (27%)**	10.32	9/24/01
Starhope above East Fork	6/28/02-10/6/02 (Fall)	22	**15 (68%)**	19.76	9/23/02	**3 (14%)**	11.42	9/15/02

There was no exceedence of cold water aquatic life criteria noted in Starhope Creek though 2002 was marginally within criteria with 10% of observation days in exceedence. Monitoring was conducted just above the East Fork of the Big Lost River. Exceedence of salmonid spawning criteria occurred at the monitoring location in both monitoring years for spring and fall spawning periods.

Temperature data for Wild Horse Creek is summarized in Table 16 and 17. Wild Horse Creek is the overall coolest temperature tributary, of significant flow, to the East Fork of the Big Lost River. Data was collected in 1999 through 2002 by the Forest Service and in 2002 by DEQ.

Table 16. Wildhorse Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Wildhorse Creek above East Fork	6/10/99-10/19/99	132	0	15.2	8/29/99	0	11.9	8/24/99
Wildhorse Creek above East Fork	5/25/00-10/3/00	132	0	18.2	8/8/00	0	13.4	8/2/00
Wildhorse Creek above East Fork	6/15/01-10/23/01	131	0	18.2	8/6/01	0	13.1	8/4/01
Wildhorse Creek above East Fork	6/29/02-10/6/02	100	0	18.9	7/12/02	0	13.9	7/14/02

Table 17. Wildhorse Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Tem**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Wildhorse Creek above East Fork	6/10/99-10/19/99 (Spring)	21	0	10.23	6/11/99	0	6.8	6/24/99
Wildhorse Creek above East Fork	6/10/99-10/19/99 (fall)	35	1 (3%)	13.13	9/15/99	1 (3%)	9.15	9/24/99
Wildhorse Creek above East Fork	5/25/00-10/3/00 (Spring)	37	**11 (30%)**	15.2	6/29/00	**8 (22%)**	10.37	6/30/00
Wildhorse Creek above East Fork	5/25/00-10/3/00 (fall)	19	**4 (21%)**	15.2	9/16/00	**5 (26%)**	10.6	9/16/00
Wildhorse Creek above East Fork	6/15/01-10/23/01 (Spring)	16	**13 (81%)**	16.7	6/29/01	**10 (63%)**	11.33	6/29/01
Wildhorse Creek above East Fork	6/15/01-10/23/01 (fall)	39	**14 (36%)**	14.4	9/24/01	**8 (21%)**	9.8	9/17/01
Wildhorse Creek above East Fork	6/29/02-10/6/02 (fall)	22	**8 (36%)**	14.14	9/19/02	**5 (23%)**	9.37	9/18/01

There was no exceedence of cold water aquatic life criteria noted in Wild Horse Creek. Monitoring was conducted just above the East Fork of the Big Lost River. Exceedence of salmonid spawning criteria occurred at the monitoring location in the 2000 through 2002 monitoring years for spring and fall spawning periods.

Temperature data for North Fork of the Big Lost River is summarized in Table 18 and 19. The North Fork of the Big Lost River originates in the northwest area of the subbasin and is slightly lower in flow to the East Fork of the Big Lost River. Data was collected in 1999 through 2002 by the Forest Service.

Table 18. North Fork Big Lost River temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
North Fork above Summit Creek	6/10/99-10/19/99	132	0	16.5	8/26/99	0	12.3	8/24/99
North Fork above Summit Creek	5/25/00-10/3/00	132	0	21.7	8/2/00	0	13.9	8/2/00
North Fork above Summit Creek	6/14/01-10/21/01	130	0	19.8	8/29/01	0	13.9	7/4/01
North Fork above Summit Creek	6/29/02-10/6/02	100	0	21.4	7/12/02	0	14.6	7/12/02

Table 19. North Fork Big Lost River temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
North Fork above Summit Creek	6/10/99-10/19/99 (Spring)	21	0	12.5	6/30/99	0	8.65	6/30/99
North Fork above Summit Creek	6/10/99-10/19/99 (Fall)	35	2 (6%)	13.13	9/15-16/99	3 (9%)	9.13	9/15-16/99
North Fork above Summit Creek	5/25/00-10/3/00 (Spring)	37	**23 (62%)**	16.7	6/28-30/01	**15 (41%)**	11.5	6/30/00
North Fork above Summit Creek	5/25/00-10/3/00 (Fall)	19	**6 (32%)**	16.3	9/15-16/00	**5 (26%)**	10.6	9/16/00
North Fork above Summit Creek	6/14/01-10/21/01 (Spring)	17	**16 (94%)**	19.0	6/29/01	**16 (94%)**	12.92	6/29/01
North Fork above Summit Creek	6/14/01-10/21/01 (Fall)	37	**15 (41%)**	14.4	9/23/01	**6 (16%)**	9.62	9/24/01
North Fork above Summit Creek	6/29/02-10/6/02 (Fall)	22	**9 (41%)**	15.6	9/15/02	2 (9%)	9.84	9/15/02

There was no exceedence of cold water aquatic life criteria noted in the North Fork of the Big Lost River. Monitoring was conducted just above Summit Creek. Exceedence of salmonid spawning criteria occurred at the monitoring location in the 2000 through 2001 monitoring years for spring and fall spawning periods and during spring monitoring in 2002.

Temperature data for Summit Creek is summarized in Table 20 and 21. Summit Creek originates in the western area of the North Fork Big Lost River subbasin and is the largest tributary to the North Fork. Data was collected in 1999 through 2002 by the Forest Service.

Table 20. Summit Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Summit Creek above North Fork	6/10/99-10/19/99	132	0	16.8	8/26/99	0	12.0	8/24/99
Summit Creek above North Fork	5/25/00-10/3/00	132	0	18.6	8/2/00	0	13.4	8/2/00
Summit Creek above North Fork	6/14/01-10/25/01	134	0	19.4	8/6/01	0	13.5	8/8/01
Summit Creek above North Fork	6/29/02-10/3/02	97	0	19.8	8/12/02	0	13.9	8/12/02

Table 21. Summit Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Summit Creek above North Fork	6/10/99-10/19/99 (Spring)	21	0	11.66	6/12/99	0	7.19	6/30/99
Summit Creek above North Fork	6/10/99-10/19/99 (Fall)	35	2 (6%)	13.3	9/16-17/99	0	7.95	9/25/99
Summit Creek above North Fork	5/25/00-10/3/00 (Spring)	37	**12 (32%)**	15.9	6/28-30/00	**10 (27%)**	10.42	6/30/00
Summit Creek above North Fork	5/25/00-10/3/00 (Fall)	19	**4 (21%)**	15.2	9/16/00	**5 (26%)**	10.52	9/16/00
Summit Creek above North Fork	6/14/01-10/25/01 (Spring)	17	**15 (88%)**	17.8	6/29/01	**14 (82%)**	11.64	6/29/01
Summit Creek above North Fork	6/14/01-10/25/01 (Fall)	41	**7 (17%)**	14.1	9/24/01	4 (10%)	9.53	9/15/01
Summit Creek above North Fork	6/29/02-10/3/02 (Fall)	19	**3 (16%)**	14.02	9/15/02	**3 (16%)**	10.07	9/15/02

There was no exceedence of cold water aquatic life criteria noted in Summit Creek. Monitoring was conducted just above the North Fork of the Big Lost River. Exceedence of salmonid spawning criteria occurred at the monitoring location in the 2000 through 2001 monitoring years for spring spawning and the spring spawning period in 2001. Both spring and fall periods were in violation of criteria in 2002.

Temperature data for the Big Lost River at the Howell Ranch is summarized in Table 22 and 23. The Big Lost River originates at the confluence of the North Fork Big Lost River and the East Fork of the Big Lost River. Data was collected in 1996 and 1999 by the USGS.

Table 22. USGS Big Lost River at Howell Ranch Temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Big Lost at Howell Ranch	6/18/96-9/15/96	90	0	17.3	8/10/96	0	13.9	8/11-13/96
Big Lost at Howell Ranch	5/28/99-9/30/99	122	0	17.2	8/26/99	0	14.3	8/24/99

Table 23. USGS Big Lost River at Howell Ranch temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Big Lost at Howell Ranch	6/18/96-9/15/96 (Spring)	13	**2 (15 %)**	14.6	6/30/96	**3 (23%)**	11.1	6/30/96
Big Lost at Howell Ranch	6/18/96-9/15/96 (Fall)	1	0	9.9	9/15/96	0	8.0	9/15/96
Big Lost at Howell Ranch	5/28/99-9/30/99 (Spring)	34	0	13.0	6/23-24/99	3 (8%)	9.6	6/30/99
Big Lost at Howell Ranch	5/28/99-9/30/99 (Fall)	16	1 (6%)	13.3	6/15/99	**11 (73%)**	10.4	9/15/99

There was no exceedence of cold water aquatic life criteria noted in the Big Lost River at the Howell Ranch. Exceedence of salmonid spawning criteria occurred at the monitoring location in the 1996 monitoring period for spring spawning and the fall spawning period in 1999. There was no major exceedence of temperature criteria for the fall spawning period in 1996 or the spring spawning period in 1999.

There is no meaningful temperature data for the remaining reach of the Big Lost River to the Mackay Reservoir. Dry channels throughout the majority of critical time periods for salmonid spawning below Chilly Buttes, during the evaluation period, precluded assessing the temperature regime. From data at the Howell ranch it can be projected that during brief periods of flow there would not be temperature issues related to cold water aquatic life standards.

Temperature data for lower Warm Springs Creek is summarized in Table 24 and 25. Warm Springs Creek originates at Hamilton Springs. There is a hatchery located at the source of the springs. Data was collected by DEQ in 2002 and 2003.

Table 24. Warm Springs Creek Temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Warm Springs Creek above Reservoir	7/12/2002-11/13/2002	125	0	21.7	7/12/02	0	15.4	7/12/02
Warm Springs Creek above Reservoir	5/7/03-9/24/03	141	0	20.9	7/22/03	0	14.7	8/21/03

Table 25. Warm Springs Creek Temperature data and number of days where water temperatures exceeded the Salmonid Spawning criteria.

		Salmonid Spawning						
			13°C Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Warm Springs Creek above Reservoir	7/12/2002-11/13/2002 (Fall)	60	**14 (23%)**	15.2	9/19/02	**12 (20%)**	10.9	9/15/02
Warm Springs Creek above Reservoir	5/7/03-9/24/03 (Spring)	55	**52 (95%)**	20.9	5/24/03	**49 (89%)**	14.5	6/29/03
Warm Springs Creek above Reservoir	5/7/03-9/24/03 (Fall)	10	**5 (50%)**	14.8	9/23/03	**5 (50%)**	9.88	9/23/03

There was no exceedence of cold water aquatic life criteria noted in Warm Springs Creek at the Gregory Ranch above Mackay Reservoir. Exceedence of salmonid spawning criteria occurred at the monitoring location in the 2002 and 2003 monitoring period for spring and fall spawning periods.

Temperature data for Antelope Creek is summarized in Table 26 and 27. Antelope Creek is a tributary to the Big Lost River just above the Moore Diversion where the Big Lost River is generally diverted for irrigation. Antelope Creek, like the Big Lost River is ephemeral over its lower reach. Data was collected from 1999 through 2002 by the Forest Service and in 2003 by DEQ.

Table 26. Antelope Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	Sample Period	# Days Evaluated	# Days Over	Max Temp	Max Date	# Days Over	Max Temp	Max Date
Antelope Creek at Forest Boundary	6/12/99-10/19/99	130	0	17.4	8/23/99	0	13.2	8/24/99
Antelope Creek at Forest Boundary	5/25/00-10/20/00	149	0	19.4	8/2/00	0	16.1	8/2/00
Antelope Creek at Forest Boundary	6/14/01-10/23/01	132	0	20.9	8/5/01	0	16.4	8/5/01
Antelope Creek at Forest Boundary	6/29/02-10/6/02	100	0	21.0	8/12/01	0	15.7	8/15/01
Antelope Creek 0.25 mi. below Forest Boundary	5/7/03-9/24/03	141	0	20.9	8/21/03	0	15.6	8/21/03
Lower Antelope Creek at South Fk Diversion	5/7/03-6/13/03	35	3 (8%)	23.2	6/6&8 /03	0	15.1	6/9/03

Table 27. Antelope Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	Sample Period (season)	# Days Evaluated	# Days Over	Max Temp	Max Date	# Days Over	Max Temp	Max Date
Antelope Creek at Forest Boundary	6/12/99-10/19/99 (Spring)	19	1 5%)	13.13	6/30/99	0	8.72	6/30/99
Antelope Creek at Forest Boundary	6/12/99-10/19/99 (Fall)	35	2 (6%)	13.13	9/15 &17/99	0	8.9	9/17/99
Antelope Creek at Forest Boundary	5/25/00-10/20/00 (Spring)	37	**22 (59%)**	17.8	6/30/00	**20 (54%)**	12.78	6/30/00
Antelope Creek at Forest Boundary	5/25/00-10/20/00 (Fall)	36	3 (8%)	15.2	9/15/00	**8 (22%)**	12.24	9/16/00
Antelope Creek at Forest Boundary	6/14/01-10/23/01 (Spring)	17	**16 (94%)**	19.0	6/29/01	**16 (94%)**	13.86	6/29/01
Antelope Creek at Forest Boundary	6/14/01-10/23/01 (Fall)	39	**9 (23%)**	15.6	9/15/01	**12 (31%)**	10.7	9/15/01
Antelope Creek at Forest Boundary	6/29/02-10/6/02 (Fall)	22	2 (9%)	14.09	9/15/02	2 (9%)	10.02	9/15/02
Antelope Creek 0.25 mi. below Forest Boundary	5/7/03-9/24/03 (Spring)	55	**17 (31%)**	17.4	6/30/03	**14 (25%)**	12.78	6/30/03
Antelope Creek 0.25 mi. below Forest Boundary	5/7/03-9/24/03 (Fall)	10	**5 (50%)**	14.4	9/22-24/03	**4 (40%)**	9.63	9/23/03
Lower Antelope Creek at South Fk Diversion	5/7/03-6/13/03 (Spring)	38	**30 (8%)**	23.2	6/6&8 /03	**27 (77%)**	15.1	6/9/03

There were 3 days exceedence of cold water aquatic life criteria temperature in Antelope Creek at the South Fork of Antelope Creek Diversion, however, the exceedence did not occur between June 22nd and September 21st. The natural stream channel was dry below the diversion on May 19th and the temperature logger was removed from the water after June 13th and draped over the fence at the sample location. Exceedence of salmonid spawning criteria occurred at the South Fork of Antelope Creek Diversion monitoring location prior to corruption of data collection in the 2003 monitoring period.

Spawning temperature criteria were exceeded in Antelope Creek at the Forest Boundary monitoring location used by the Forest Service during spring 2000 and 2001. Fall spawning criteria were exceeded at this location in 2000 for daily average temperature and for instantaneous temperature and daily average temperature in 2001. There was no exceedence of temperature criteria for salmonid spawning in spring or fall of 1999 or 2002 at the Forest Service monitoring location. Spring and fall Criteria were exceeded 0.25 mi. below the Forest boundary, at the DEQ monitoring location in 2003.

Temperature data for Bear Creek is summarized in Table 28 and 29. Bear Creek is a tributary to Antelope Creek above the Forest Boundary. The majority of flow is across lands managed by the Forest Service, however the lower mile of flow is across private land. The Forest Service collected data from 1999 through 2002 above the confluence with Antelope Creek at the Forest Boundary.

Table 28. Bear Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			19°C Daily Ave.		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Bear Creek at Forest Boundary	6/9/99-10/19-99	133	0	18.1	8/24/99	0	13.9	8/24/99
Bear Creek at Forest Boundary	5/25/00-10/3/00	132	0	21.7	8/2/00	0	16.6	8/2/00
Bear Creek at Forest Boundary	6/14/01-10/25/01	134	0	21.3	8/7/01	0	16.6	7/5/01
Bear Creek at Forest Boundary	6/29/02-10/6/02	100	1 (1%)	22.1	7/12/02	0	16.9	7/15/02

Table 29. Bear Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			**9°C Daily Ave.**		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Bear Creek at Forest Boundary	6/9/99-10/19-99 (Spring)	22	0	12.83	6/24/99	0	9.0	6/24/99
Bear Creek at Forest Boundary	6/9/99-10/19-99 (Fall)	35	**8 (23%)**	13.72	9/16 &21/99	**8 (23%)**	9.74	9/24/99
Bear Creek at Forest Boundary	5/25/00-10/3/00 (Spring)	37	**22 (59%)**	17.4	6/30/00	**26 (70%)**	12.77	6/30/00
Bear Creek at Forest Boundary	5/25/00-10/3/00 (Fall)	19	**6 (32%)**	16.7	9/16/00	**8 (42%)**	12.39	9/16/00
Bear Creek at Forest Boundary	6/14/01-10/25/01 (Spring)	17	**15 (88%)**	19.4	6/29/01	**16 (94%)**	14.15	6/30/01
Bear Creek at Forest Boundary	6/14/01-10/25/01 (Fall)	41	**16 (39%)**	15.2	9/24/01	**19 (46%)**	11.05	9/15/01
Bear Creek at Forest Boundary	6/29/02-10/6/02 (Fall)	22	**6 (27%)**	15.62	9/15/02	**5 (23%)**	11.16	9/15/02

There was no major exceedence of cold water aquatic life criteria noted in Bear Creek at the Forest boundary. Exceedence of salmonid spawning criteria occurred at the monitoring location in the fall of 1999 but there was no exceedence during the spring monitoring period at that location. Spring and fall spawning criteria were exceeded in 2000, 2001, and 2002 at the monitoring location.

Temperature data for Cherry Creek is summarized in Table 30 and 31. Cherry Creek is a tributary to Antelope Creek below Bear Creek. The majority of flow is across lands managed by the Forest Service, however the lower 3 miles of flow is across private land. The Forest Service collected data from 1999 through 2002 at the Forest Boundary.

Table 30. Cherry Creek temperature data and number of days where water temperatures exceeded the cold water aquatic life criteria.

		Cold Water Aquatic Life						
			22°C Inst.			**19°C Daily Ave.**		
Stream Name	**Sample Period**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Cherry Creek At Forest Boundary	6/9/99-10/19/99	133	0	18.8	7/13/99	0	15.6	8/24/99
Cherry Creek At Forest Boundary	5/25/00-10/4/00	133	0	19.4	8/2/00	0	17.6	8/2/00
Cherry Creek At Forest Boundary	6/14/01-10/24-01	133	0	20.6	7/5/01	0	18.2	7/5/01
Cherry Creek At Forest Boundary	6/30/02-10/6/02	99	0	21.6	7/12/02	2 (2%)	19.5	7/15/02

Table 31. Cherry Creek temperature data and number of days where water temperatures exceeded the salmonid spawning criteria.

		Salmonid Spawning						
			13 Inst.			9°C Daily Ave.		
Stream Name	**Sample Period (season)**	**# Days Evaluated**	**# Days Over**	**Max Temp**	**Max Date**	**# Days Over**	**Max Temp**	**Max Date**
Cherry Creek At Forest Boundary	6/9/99-10/19/99 (Spring)	22	**19 (86%)**	17.12	6/20/99	**20 (91%)**	12.89	6/21/99
Cherry Creek At Forest Boundary	6/9/99-10/19/99 (Fall)	35	2 (6%)	13.13	9/15& 24/99	**11 (31%)**	10.94	9/24/99
Cherry Creek At Forest Boundary	5/25/00-10/4/00 (Spring)	37	**36 (97%)**	18.2	6/4/00	**37 (100%)**	15.62	6/29/00
Cherry Creek At Forest Boundary	5/25/00-10/4/00 (Fall)	20	**5 (25%)**	14.10	9/15-16/00	**11 (55%)**	13.2	9/17/00
Cherry Creek At Forest Boundary	6/14/01-10/24-01 (Spring)	17	**16 (94%)**	18.28	6/22/01	**16 (94%)**	16.44	6/29-30/01
Cherry Creek At Forest Boundary	6/14/01-10/24-01 (Fall)	40	0	12.93	9/15/01	**21 (53%)**	12.35	9/15/01
Cherry Creek At Forest Boundary	6/30/02-10/6/02 (Spring)	1	1 (100%)	18.68	6/30/02	1 (100%)	16.47	6/30/02
Cherry Creek At Forest Boundary	6/30/02-10/6/02 (Fall)	22	0	12.97	9/15/02	**11 (50%)**	12.12	9/15/02

There was no major exceedence of cold water aquatic life criteria noted in Cherry Creek at the Forest boundary. Exceedence of salmonid spawning criteria occurred at the monitoring location in the Spring of 1999, 2000, and 2001. Fall spawning criteria were exceeded 2001at the monitoring location.

Water Chemistry Data

The USGS collected water chemistry and nutrient samples at the Howell Ranch stream gage in 1996 and 1999. That data is summarized in Table 32 and 33.

Table 32. USGS water column data pertaining to water quality from 1996.

Date	Time	Flow (cfs)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Hardness Total (mg/L as $CaCO_3$)	Alkalinity Total (mg/L as $CaCO_3$)
6/3/96	1053	1,160	125	8.0	3.5	10.2		
6/17/96	1315	2,000	94	7.9	16	11.1		
7/15/96	1308	563	130	8.2	0.7	9.3		
8/19/96	1330	1,480	183	8.1	0.3	8.6		
9/16/96	1215	154	195	8.1	1.3	9.5	91	83

Table 33. USGS water column data pertaining to water quality from 1999.

Date	Time	Flow (cfs)	Conductivity (µS/cm)	pH	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Hardness Total (mg/L as $CaCO_3$)	Alkalinity Total (mg/L as $CaCO_3$)
5/27/99	1452	1,860	106	8.2	55	11.1		
6/24/99	1240	1,770	97	8.3	9.5	10.2		
8/6/99	1120	359	148	8.3	--	9.5		
9/22/99	1155	120	194	8.3	0.50	10.2		
10/7/99	1340	123	195	8.3	0.50	9.8	89	--

State water quality criteria specify a limit of 50 NTU above background for turbidity below an applicable mixing zone. There is no background data to compare with turbidity values, and the Howell Ranch monitoring location is not an applicable mixing zone related to any particular feature so a reading of 55 NTU on May 27th 1999 is not a significant exceedence of water quality criteria. The chronic criteria for turbidity is not to exceed 25 NTU for greater than 10 days. It is undetermined what the 10-day duration of turbidity was to relate to the chronic criteria limit of 25 NTU. The turbidity data from 1996 and 1999 are within state water quality standards set for turbidity. No other water quality parameters were exceeded.

As part of an ongoing evaluation of mine tailings affiliated with the Empire Mine, near Mackay, Idaho, the DEQ collected upgradient and downgradient samples for water column dissolved metals. Mine tailings are partially situated in the flood plain of the Big Lost River on the western valley bottom. Results of that sampling are summarized in Table 34 and 35. At total hardness of 100 mg/L the standard for copper is 11 micrograms per liter. The upgradient sample for copper was below criteria at 9.6 micrograms per liter at 100 mg/L hardness. No hardness sample was collected at the time metals samples were collected. Hardness would likely increase progressively downstream and is likely over 100, which would increase the criteria threshold. All other parameters sampled were below detection limits for the methodologies used.

Table 34. Water column metals sample in the Big Lost River upgradient of Empire Mine tailings pile in flood plain.

Date	Metal (dissolved)	Result (µg/L)	Method
8/26/03	Silver	<0.0050	200.7
8/26/03	Arsenic	<0.0030	206.2
8/26/03	Beryllium	<0.0020	200.7
8/26/03	Cadmium	<0.0020	200.7
8/26/03	Chromium	<0.0060	200.7
8/26/03	Copper	0.0096	200.7
8/26/03	Mercury	<0.00020	245.1
8/26/03	Nickel	<0.010	200.7
8/26/03	Lead	<0.0030	239.2
8/26/03	Antimony	<0.0050	200.7
8/26/03	Selenium	<0.0030	270.2
8/26/03	Thallium	<0.0020	279.2
8/26/03	Zinc	<0.0050	200.7

Table 35. Water column metals sample in the Big Lost River downgradient of Empire Mine tailings pile in flood plain.

Date	Metal (dissolved)	Result (µg/L)	Method
8/26/03	Silver	<0.0050	200.7
8/26/03	Arsenic	<0.0030	206.2
8/26/03	Beryllium	<0.0020	200.7
8/26/03	Cadmium	<0.0020	200.7
8/26/03	Chromium	<0.0060	200.7
8/26/03	Copper	<0.0030	200.7
8/26/03	Mercury	<0.00020	245.1
8/26/03	Nickel	<0.010	200.7
8/26/03	Lead	<0.0030	239.2
8/26/03	Antimony	<0.0050	200.7
8/26/03	Selenium	<0.0030	270.2
8/26/03	Thallium	<0.0020	279.2
8/26/03	Zinc	<0.0050	200.7

Nutrient Data was also collected by the USGS at this location at the same time and is summarized (Table 36 and 37).

Table 36. USGS water column data pertaining to nutrients from 1996.

Date	Time	Nitrite-N Dissolved, (mg/L as N)	NO_2+NO_3 Dissolved (mg/L as N)	Organic Ammonia (mg/L as N)	Total Phos. (mg/L as P)	Dissolved Ortho Phos. (mg/L as P)	Total Suspended Sediment mg/L	TSS Discharge (T/Day)
6/3/96	1053	<0.01	<0.05	<0.015	<0.01	0.01	136	426
6/17/96	1315	<0.01	0.08	0.03	0.06	0.02	198	1070
7/15/96	1308	<0.01	0.07	0.03	0.01	0.01	12	18
8/19/96	1330	<0.01	<0.05	<0.015	0.01	<0.01	1	4.0
9/16/96	1215	<0.01	<0.05	<0.015	<0.01	0.01	2	0.83

Table 37. USGS water column data pertaining to nutrients from 1999

Date	Time	Nitrite-N Dissolved, (mg/L as N)	NO_2+NO_3 Dissolved (mg/L as N)	Organic Ammonia (mg/L as N)	Total Phos. (mg/L as P)	Dissolved Ortho Phos. (mg/L as P)	Total Suspended Sediment mg/L	TSS Discharge (T/Day)
5/27/99	1452	<0.01	0.086	0.90	0.250	0.018	132	663
6/24/99	1240	<0.01	0.073	0.17	0.106	0.013	102	487
8/6/99	1120	<0.01	<0.05	0.16	<0.05	0.017	5	4.8
9/22/99	1155	<0.01	<0.05	<0.10	<0.05	<0.010	1	0.32
10/7/99	1340	<0.01	<0.05	<0.10	<0.05	<0.010	1	0.33

Excessive concentrations of nutrients in fresh water, particularly nitrogen and phosphorous, may diminish water quality and impair beneficial uses through the process of eutrophication or excessive growth of aquatic plants or algae. According to IDAPA 58.01.02.200.06, surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growth impairing designated beneficial uses. There is not nutrient data available for the mouth of the Big Lost River at Mackay Reservoir, however, it should be noted that there are no indications of nuisance levels of aquatic plants in the reservoir or issues with oxygen depletion in the reservoir. During runoff conditions total phosphorus is elevated above suggested criteria for waters flowing into reservoirs but concentrations drop to below that level during non-runoff periods when the Big Lost River does not normally make a confluence with the reservoir.

Nutrient data was collected by DEQ at several locations on Warm Springs Creek and below the Idaho Fish and Game Hatchery on Whiskey Springs (a tributary to Warm Springs Creek) during the subbasin evaluation. That data is summarized in Table 38, 39, and 40.

Table 38. Nutrient data from select tributaries above Mackay Reservoir in May 2003.

Date	Location	NO_2+NO_3 (mg/L as N)	Total Phos. (mg/L as P)
5/8/03	Whiskey Creek	0.082	0.110
5/8/03	Upper Warm Springs	0.088	0.032
5/8/03	Lower Warm Springs Creek	0.092	0.018
5/8/03	Twin Bridges Creek	<0.005	0.039

Table 39. Nutrient data collected at select Big Lost River sites in August 2003.

Date	Location	NO_2+NO_3 (mg/L as N)	Total Kjeldahl N	Total Phos. (mg/L as P)
8/26/03	Big Lost at Bartlett Point	<0.005	0.09	0.01
8/26/03	Warm Springs Creek (lwr)	0.112	0.18	0.014
8/26/03	Pass Creek (lower)	0.078	0.16	0.049
8/26/03	Big Lost at Empire Mine	0.007	0.17	0.016

Table 40. Nutrient data from Warm Springs Creek and Whiskey Creek in June 2002.

Date	Location	NO_2+NO_3 (mg/L as N)	Total Phos. (mg/L as P)
6/26/02	Whiskey Creek	0.077	0.023
6/26/02	Upper Warm Springs	0.086	0.027
6/26/02	Lower Warm Springs Creek	0.133	0.134
6/26/02	Warm Springs at source	0.113	0.015

Nutrient analysis was conducted by Idaho State University in 2000. It was determined that the Big Lost River is phosphorus limited and N levels are extremely low except at the Arco Bridge, near Arco, where the Big Lost exhibited elevated levels of nitrate during a short period of flow probably due to irrigation return water (Myler and Minshall, 2001).

Nutrient levels monitored in Warm Springs Creek show slight elevation of phosphorus in relation to EPA recommended criteria for reservoir inflow. During assessments, however, nuisance levels of aquatic plants were not observed in Warm Springs Creek or Whiskey Creek. There is no apparent issue with algae concentrations or oxygen depletion in Mackay Reservoir. This may be due to high turnover rates and cool temperatures as evidenced by monitoring below Mackay Dam.

Biological and Other Data

Streambank Erosion Assessments

The DEQ utilizes streambank erosion inventories (SEI) as means to assess current erosion conditions within a stream. This method is very useful in identifying load reductions necessary to achieve desired future conditions that are expected to restore beneficial uses to a stream. Other erosional features are evaluated during SEI data collection. Other significant sediment sources were not identified including roads, mass wasting and hillslope erosion. Mass wasting and hill slope erosion are included in natural background and are not considered to be above the level of natural background loading.

DEQ SEIs are conducted in accordance with methods outlined in proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (NRCS 1983). The NRCS technique evaluates streambank/channel stability by estimating length of stable and active eroding banks, and bank slope height. Streambank and channel stability field measurements are combined with a standardized rating of streambank character and the bank character rating is used to ascertain the long-term lateral recession rate of stream banks. The recession rate is determined from field evaluation of six streambank characteristics that are assigned a categorical rating ranging from 0 to 3. The categorical ratings are summed to a cumulative rating. From the cumulative rating a lateral recession rate is assigned ranging from slight at 0.01 feet per year to very severe at 0.5 + feet per year. An average volume of eroded bank is obtained with the estimated recession rate. By applying a measured or estimated standard bulk density based on composition of streambank material an estimate of tons of sediment from streambank erosion is obtained for comparison to other reaches or for applying a load allocation based on a prescribed reference condition. Appendix G outlines the method for conducting SEIs.
During 2002 and 2003 DEQ completed streambank erosion inventories on 303(d) listed streams, other than the Big Lost River, to evaluate stream bank stability and sediment loading from streambank erosion, a major source of sediment to rangeland streams. In Copper Basin the East Fork of the Big Lost River was inventoried from the Burma Bridge, below the source at The Swamps to below Starhope Creek. An additional reach was inventoried below Wild Horse Creek. Warm Springs Creek was inventoried from its source to just above the Mackay Reservoir, to the upper 6X Ranch boundary. In the Antelope Creek watershed streambank erosion inventories were conducted on Antelope Creek and Cherry Creek.

Substrate fine sediment composition was evaluated on the East Fork of the Big Lost River and on Star Hope Creek using the McNeil Sediment Core methodology. This evaluation aids in determining impacts to spawning habitat resulting from fine sediment less than 6.35 mm (¼ inch).

Stream bank erosion inventories and McNeil sediment core sampling was also done by the Science Action Team (SAT), a group of Arco and Mackay High School students and Idaho State University students. The Science Action Team was sponsored and supervised by the Idaho National Environmental and Engineering Laboratory in a cooperative effort with DEQ to collect data for this report. Streams evaluated by the Science Action Team included lower and middle Antelope Creek, Warm Spring Creek above Mackay Reservoir, The East Fork of the Big Lost

River, and the Spring Creek channel of the Big Lost River. Table 41 and 42 summarizes results from streambank erosion inventories conducted by SAT and DEQ respectively.

Table 42. Science Action Team Streambank Erosion Inventory Summary

Reach Location	Total Inventoried (ft)	Eroding (ft)	% Eroding	Extrapolated Length	Tons of Sediment per mile	Tons of Sediment per year
Big Lost River						
Warm Springs Creek	690	164	**24**	330	4.5	0.6
East Fork Big Lost River						
Exclosure below Corral Cr.	**1250**	**493**	**39**	350	49	9
Spring Creek						
North Section of Private Land	**460**	**428**	**93**	150	324	23
Antelope Creek						
Below S. Fk. Diversion	4046	2105	**52**	1000	170	97

Table 41. DEQ Streambank Erosion Inventory Summary

Reach Location	Total Inventoried (ft)	Eroding (ft)	% Eroding	Extrapolated Length	Tons of Sediment per mile	Tons of Sediment per year
East Fork Big Lost River						
Above Burma Bridge	2994	347	12	11,616	3	7
Above Starhope Creek	4481	1154	**26**	16,896	11	40
Below Starhope Creek	9002	4612	**51**	41290	113	980
Below Wildhorse Creek	2972	1916	**64**	2768	230	185
Warm Springs Creek						
Source to Lost River Ranch Rd.	2150	150	7	0	1	0.21
Lost River Ranch Rd to BR Ranch	900	50	6	0	1.2	0.1
Broken River Ranch to F Ranch	808	20	2	0	0.33	0.03
Freeman Ranch to Old Chilly Rd.	1800	20	1	0	0.24	0.04
Old Chilly Rd. to 5480 W.	14044	2808	20	0	3.8	5.05
5480 W. to Gregory Ranch	19852	1985	10	10560	1.9	7.38
Antelope Creek						
Forest Boundary to Cherry Cr.	45408	6810	15	0	5	23
Cherry Cr. to Antelope Rd.	23020	6906	**30**	0	26	56
Antelope Rd. to Wood Canyon	40022	20012	**50**	0	193	732
Wood Canyon to S. Fk. Antelope Creek Diversion	31660	12672	**40**	0	26	77
Cherry Creek						
Middle Fork to Private land	14361	2154	15	9293	3.96	12
Private boundary to Diversions	25133	10053	**40**	1901	16	44
Diversions to Confluence	21437	9646	**45**	2112	41	100

The objective of inventorying streambank erosion is to quantify the relationship between the percentage of bank stability and the tons of sediment from streambank erosion. This establishes a load based on the present condition and, using a future desired reference condition, a load reduction to restore beneficial use support is identified, if existing or beneficial uses are not fully supported at the time of evaluation. The future desired condition is not a water quality standard or criteria, but a guidepost or target based on frequency distribution of natural conditions found in central Idaho. The minimum desired streambank stability condition for streams has been set at 80% in previous subbasin assessments throughout the region. Looking at erosion inventories within the Big Lost River watershed with this condition in mind a strong relationship is seen between 303(d) listed streams and streams with more than 20% eroding streambanks (less than 80% streambank stability). Streams with greater than 20% eroding streambanks that do not support aquatic life beneficial uses can be identified as sediment impaired from streambank erosion. This information can be combined with fine sediment data to further illuminate impairment issues.

Fine Sediment Assessments

Fine sediment deposited in spawning habitat can reduce the survival and emergence of fish eggs and fry respectively (Hall 1986, Chapman 1988, Reiser and White 1988, McNeil and Ahnell 1964). According to Bjornn, Peery, and Garmann (1998) "Salmonid embryo survival and fry emergence are inversely related to the amount of fine sediment in stream substrates. Fine sediment can decrease the amount of dissolved oxygen (DO) available to developing embryos by impeding flow of water through the substrate and through oxidation of organic material in fine sediment. Low oxygen availability from excess fine sediment has been associated with smaller and less developed emergent fry."

Spawning habitat in streams is found in a substrate feature that is called a glide, or a pool tail-out. This is where the substrate gradient is upward, or adverse, and the surface water slope is constant or flat. This relationship provides the hydrodynamic upwelling necessary to bring oxygenated water into the nests that fish deposit eggs into, called redds. When fine sediment increases above 20% there is a measurable effect on egg and fry survival. The Forest Service has identified fine sediment less than 6.35 mm (1/4 inch) in spawning habitat at a depth of 4 inches in concentrations over 30% in volcanic watersheds and 25% in granitic watersheds as being impaired spawning habitat of poor quality. When the trend over time shows increasing percentage of subsurface fines less than 6.35 mm it is an indication that conditions for fish survival and propagation are worsening and a change in riparian management may be necessary to support aquatic life beneficial uses. Sometimes under elevated fine sediment conditions fish numbers are adequate to indicate a stable population, but aquatic insects or macroinvertebrates are impacted. This can lower the overall fish productivity of the water. This can be identified by a shift in macroinvertebrates toward a higher proportion of sediment tolerant species.

Determining percent composition of surface and depth fine sediment in spawning habitat is used as a complimentary target to track changes in sediment loading over time. McNeil and Ahnell (1964) state that, "size composition of bottom materials greatly influences water quality by affecting rates of flow within spawning beds and rates of exchange between intragravel and stream water".

McNeil Sediment Core samples can describe size composition of bottom materials in identified salmonid spawning locations. McNeil Sediment Core samples are collected by isolating a small area of the stream bottom in a glide from the current with an open stainless steel cylinder (12 inches in diameter). The cylinder is worked to a depth of approximately 4-6 inches into the spawning habitat substrate. Substrate is then removed from the cylinder, washed through a series of ten sieves (63 to .053 mm diameter openings), and then measured via volumetric displacement. Three sediment core samples are obtained (Forest Service collects five) for each site and averaged to calculate the percentage of depth fines at the sample location. The percentage of intergravel fines less than 6.35 mm (1/4 inch) in diameter is correlated with expected fry survival. Tables 43 through 45 describe sediment core sample data accumulated by DEQ, the INEEL Science Action Team (SAT), and the Forest Service.

Table 43. DEQ McNeil Sediment sample locations and percentage depth fines.

Stream	Collection Date	Location	Average % of fine material <6.35mm
East Fork Big Lost	6/24/03	30 m Above Burma Bridge	**35**
East Fork Big Lost	6/24/03	Just Above Starhope Creek Confluence	19
Starhope Creek	6/23/03	¼ mi. Below Lake Creek Confluence	**30**
Warm Springs Creek	6/25/03	Below Culvert on Gregory Ranch	**38**

Table 44. SAT McNeil Sediment sample locations and percentage depth fines.

Stream	Collection Date	Location	Average % of fine material <6.35mm
Spring Creek	8/2/01	By Bridge on North Section of Private	**53**
Big Lost River	8/6/01	Big Lost Ranch above Reservoir	**61**
Antelope Creek	7/17/01	Below S, Fk. Diversion	27
Antelope Creek	7/24/01	Above Bridge at Antelope Guard Station	**49**

Table 45. Forest Service McNeil fine sediment trend monitoring for Big Lost River

Stream/Station	1995 %Fine	1996 %fine	1997 %fine	1998 %fine	1999 %fine	2000 %fine	2001 %fine	2002 %fine	95-02 Trend
Antelope	18.9	-	25.0	22.1	24.1	25.5	25	24.3	Increase
Cherry	28.0	-	**47.2**	25.3	**42.8**	24.3	**40.7**	**44.2**	Increase
East Fork BLR 1R	10.6	24.8	**36.7**	25.6	**30.4**	**30.0**	**29.7**	**40.9**	Increase
East Fork BLR 2R	21.9	23.4	**32.3**	17.5	**30.6**	23.0	22.9	24.6	Increase
East Fork BLR 3R	23.5	**28.7**	**28.9**	24.4	23.7	22.7	20.5	22.6	Reduce
Muldoon	27.2	-	27.5	11.7	20.5	16.0	22.3	24.5	Reduce
North Fork BLR 1R	24.8	21.9	**28.6**	16.0	**31.3**	**28.2**	**32.2**	**33.3**	Increase
North Fork BLR 2R	**32.1**	**29.1**	**36.0**	25.3	**32.9**	**37.1**	25.3	**39.0**	Increase
Pass 1R	17.0	-	-	16.0	24.5	**28.4**	**28.2**	23.7	Increase
Star Hope 1R	21.0	-	**29.4**	**30.1**	25.5	**29.1**	27.6	27.4	Increase
Wildhorse	24.5	-	**36.0**	18.5	30.2	28.0	32.8	37.8	Increase

Fisheries Sampling Data

Electrofishing has been conducted throughout the Big Lost River watershed since the middle 1980's. Overall fisheries conditions are described in the Fisheries section of the Watershed Characterization of the Subbasin Assessment. In 2003 a concerted effort was made to collect fisheries data at key locations in Copper Basin, on the North Fork of the Big Lost River, the upper Big Lost River, and important tributaries. Summaries of that data for the larger waters will be shown here with more dispersed data for smaller waters included in Appendix F with BURP summaries.

Figure 77 shows the length frequency distribution for fish collected on the upper East Fork of the Big Lost River in August 2003 by a combined group of IDFG and Forest Service fisheries personnel. Multiple age classes of brook trout were collected in good abundance.

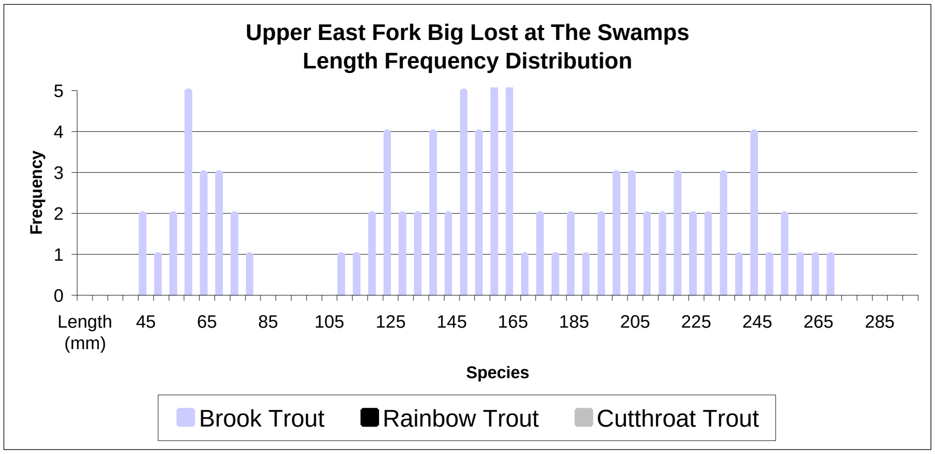

Figure 77. Upper East Fork Big Lost River length frequency distribution for fish collected near the source just below The Swamps.

Figure 78 shows the length frequency distribution for fish collected on the upper section of the East Fork of the Big Lost River. Multiple age classes of brook trout and hatchery rainbow trout were collected in good abundance.

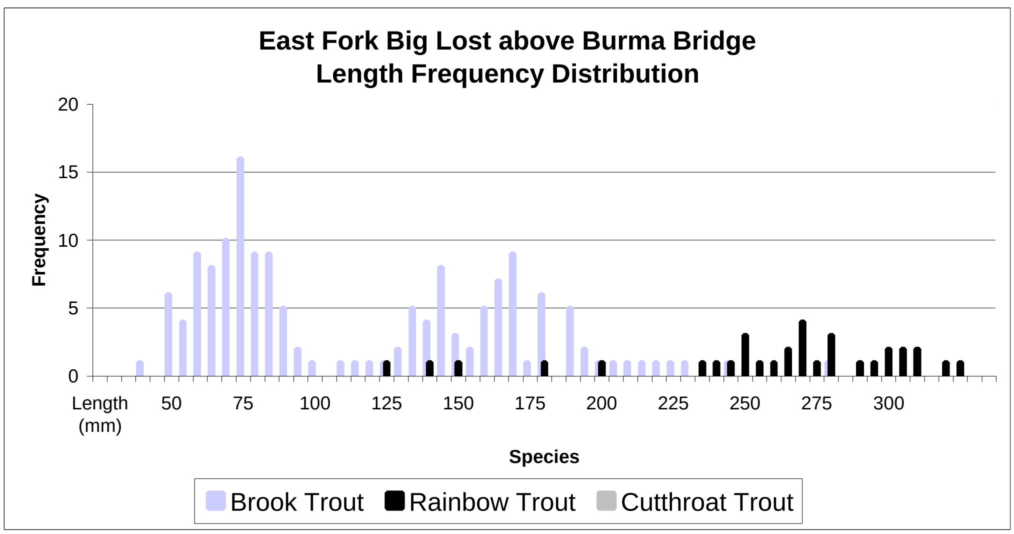

Figure 78. Upper East Fork Big Lost River length frequency distribution for fish collected above the Burma Rd. Bridge.

Figure 79 shows the length frequency distribution for fish collected on the middle section of the East Fork of the Big Lost River below the confluence of Star Hope Creek. Multiple age classes of brook trout and hatchery rainbow trout were collected., however in decreasing abundance relative to other collection sites.

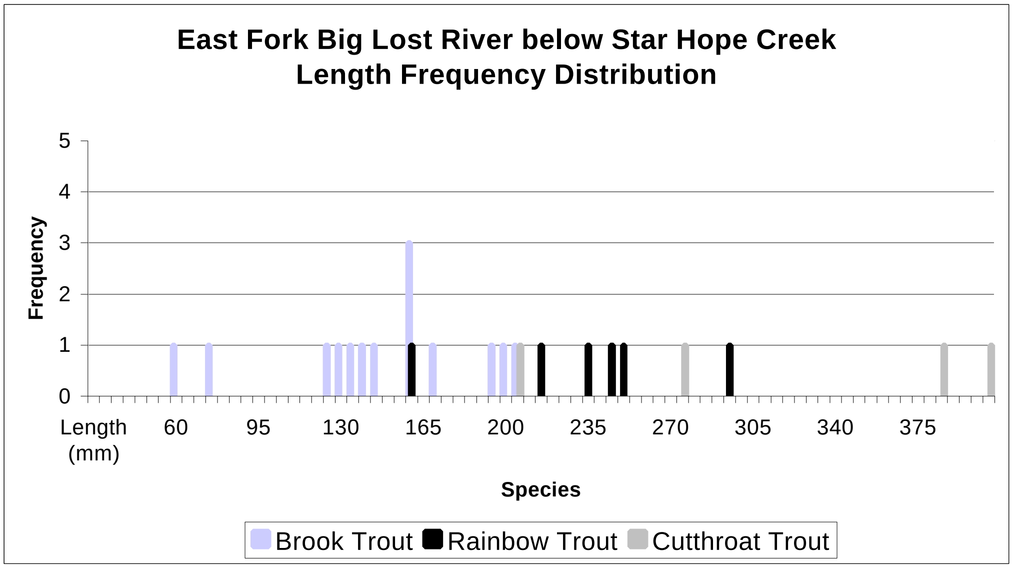

Figure 79. Middle East Fork Big Lost River length frequency distribution for fish collected below Star Hope Creek.

Figure 80 shows the length frequency distribution for fish collected on the lower section of the East Fork of the Big Lost River 1 mile above the confluence of Wild Hors Creek, ½ mile below private land. Multiple age classes of brook trout and wild and hatchery rainbow trout were collected. Fewer brook trout were found, but wild rainbow trout were more abundant.

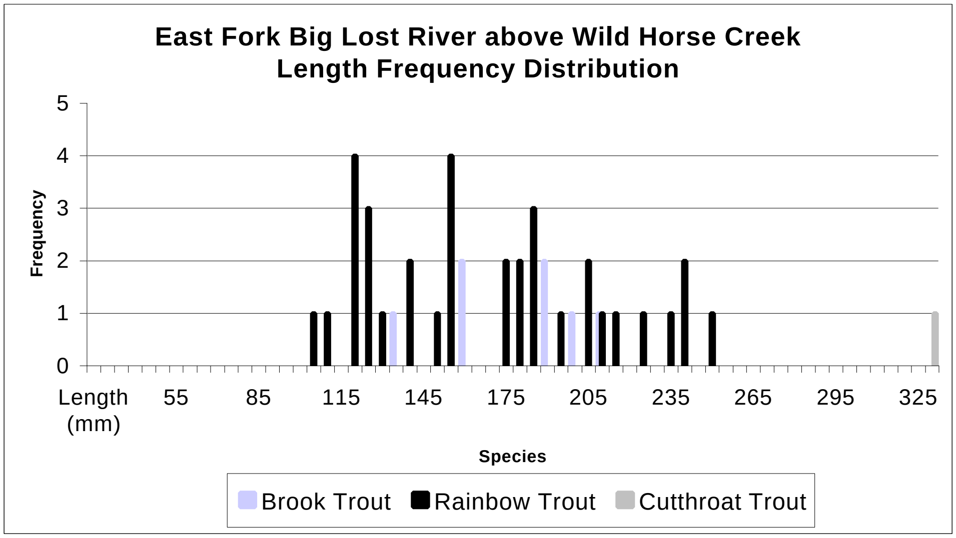

Figure 80. Lower East Fork Big Lost River length frequency distribution for fish collected above Wild Horse Creek.

Figure 81 shows the length frequency distribution for fish collected on the upper section of the North Fork of the Big Lost River at Squib Canyon. Multiple age classes of brook trout and 1 rainbow trout were collected.

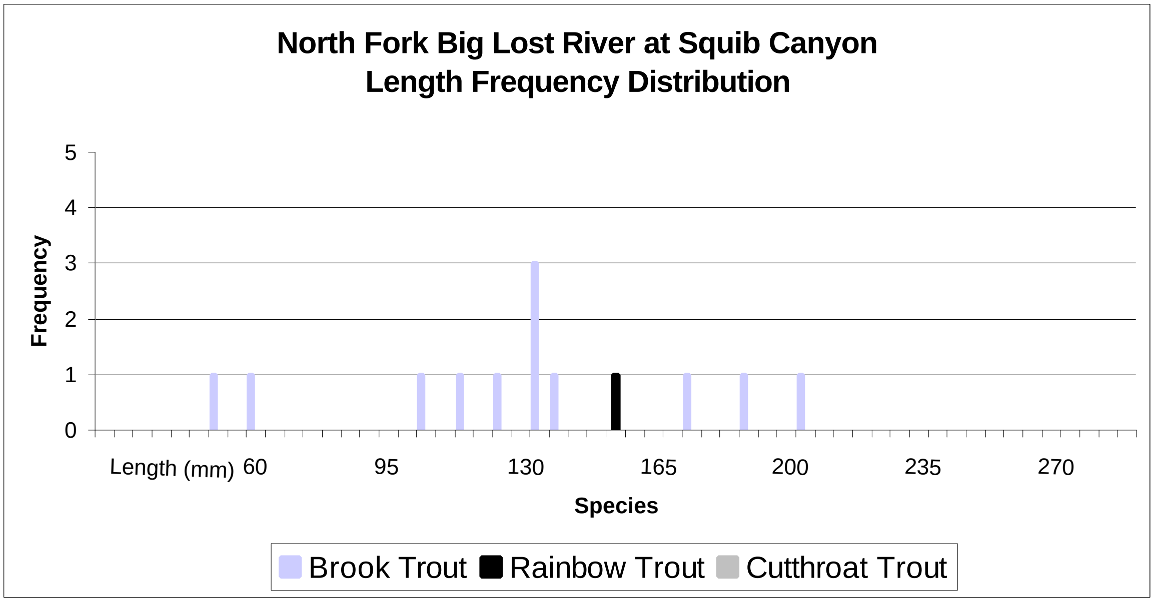

Figure 81. Upper North Fork Big Lost River length frequency distribution for fish collected at Squib Canyon.

Figure 82 shows the length frequency distribution for fish collected on the middle section of the North Fork of the Big Lost River below Burnt Creek. Multiple age classes of brook trout and rainbow trout were collected.

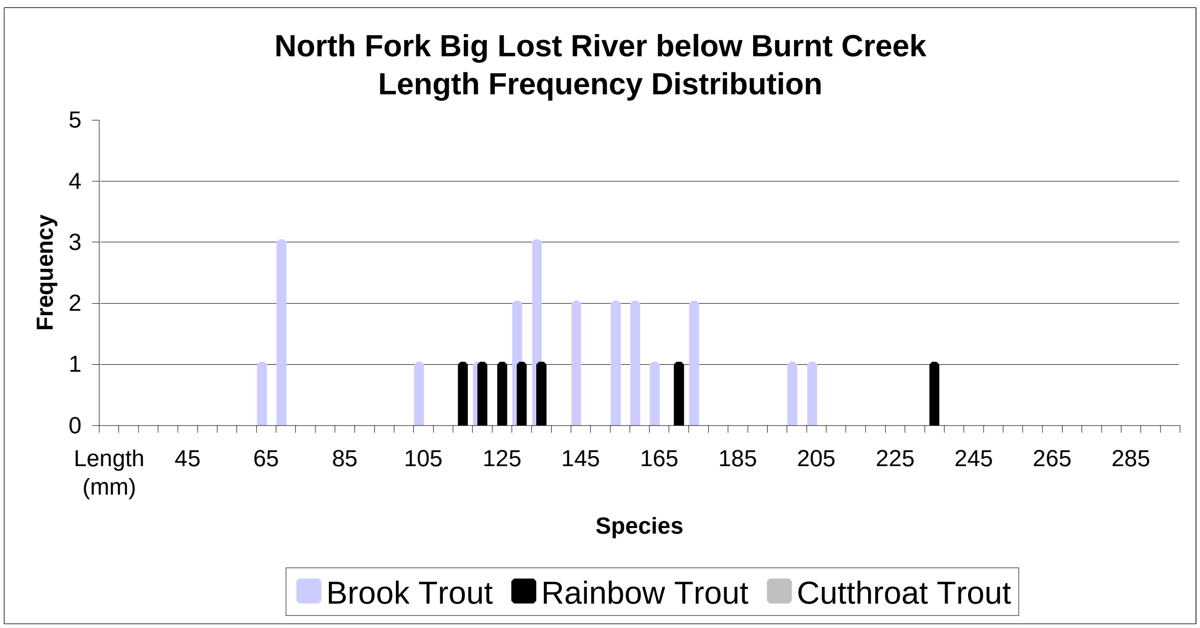

Figure 82. Middle North Fork Big Lost River length frequency distribution for fish collected below Burnt Creek.

Figure 83 shows the length frequency distribution for fish collected on the lower section of the North Fork of the Big Lost River just above Deep Creek. Multiple age classes of brook trout and rainbow trout were collected. Fish above 145 mm were hatchery rainbow trout stocked that year.

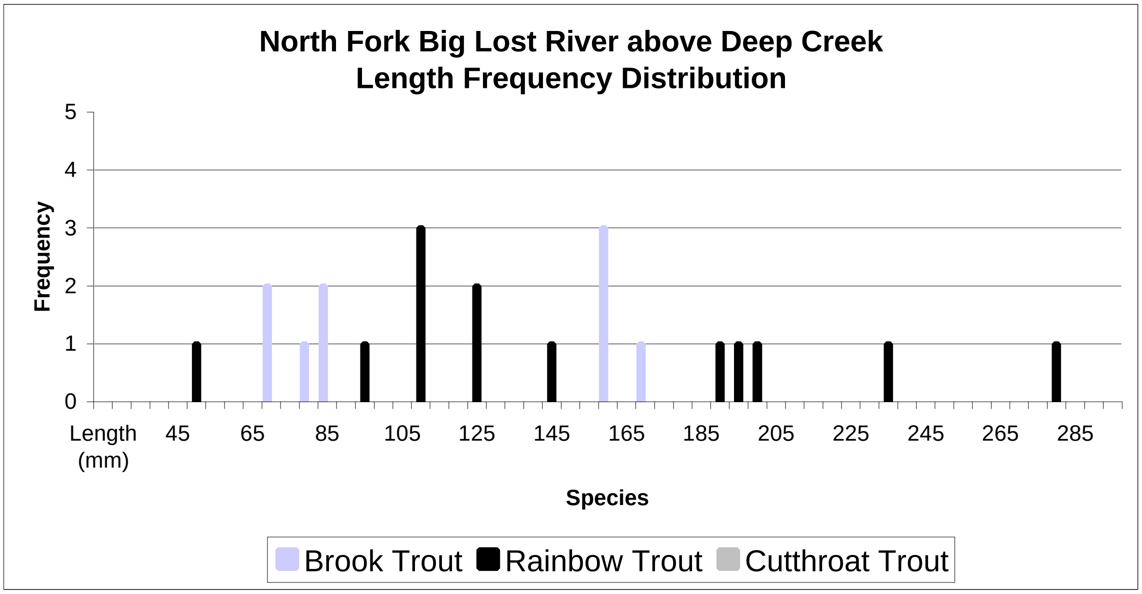

Figure 83. Lower North Fork Big Lost River length frequency distribution for fish collected just above Deep Creek.

Figure 84 shows the length frequency distribution for fish collected on the upper Big Lost River at Bartlett Point. Multiple age classes of brook trout and rainbow trout were collected. Fish above 145 mm were hatchery rainbow trout stocked that year.

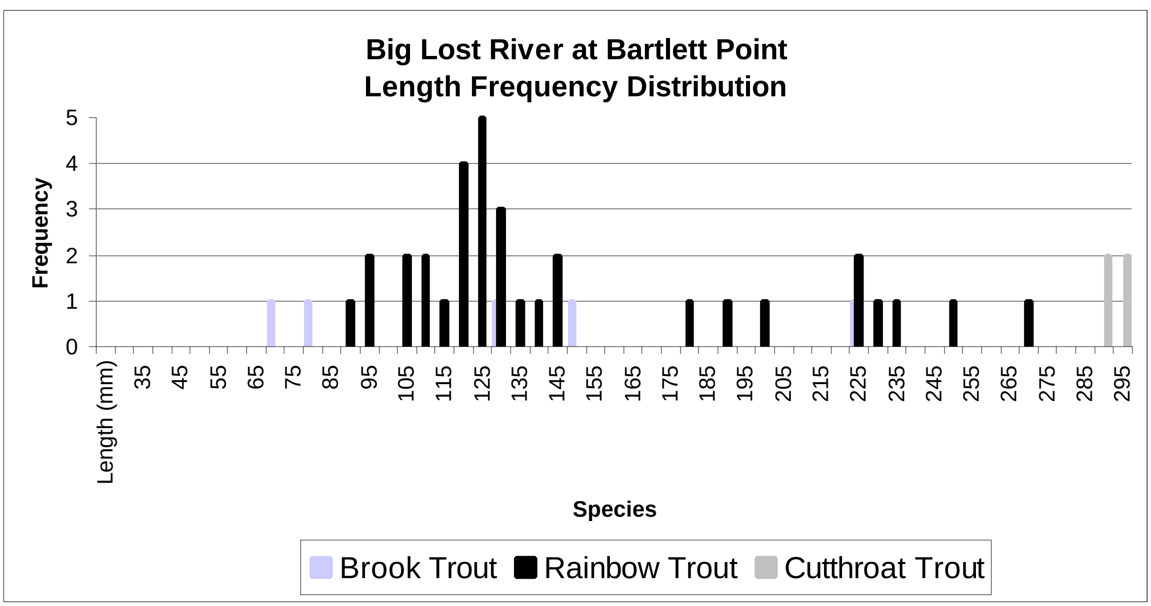

Figure 84. Big Lost River length frequency distribution for fish collected at Bartlett Point.

Figure 85 shows the length frequency distribution for fish collected on upper Antelope Creek above Horsethief Creek in 1996. Multiple age classes of brook trout were collected.

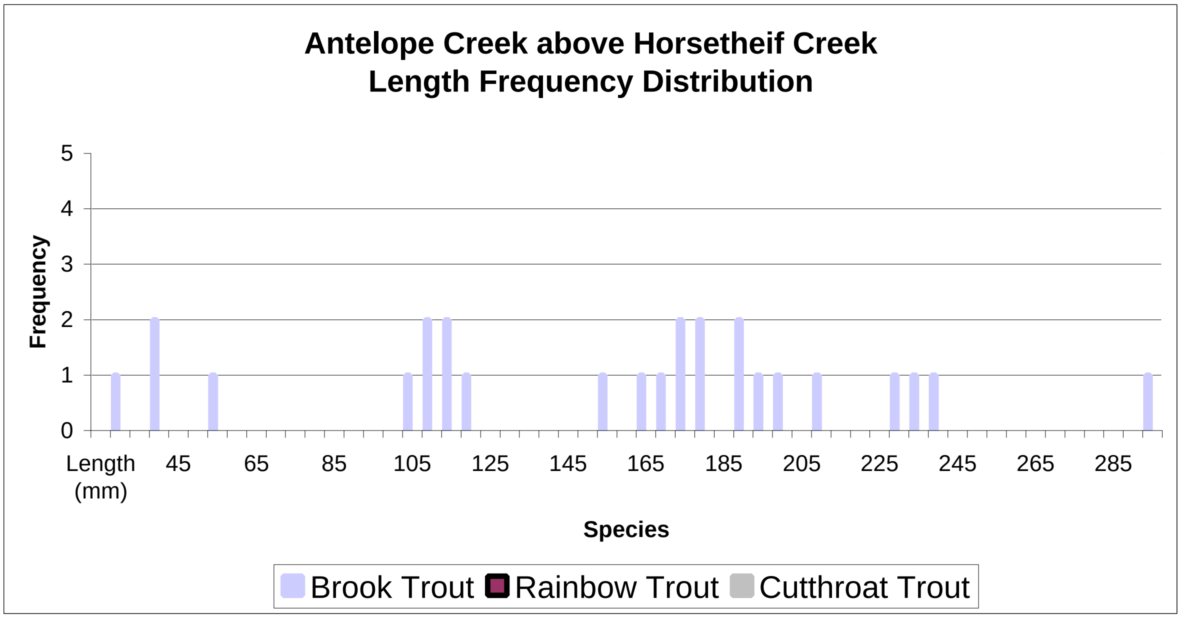

Figure 85 Antelope Creek length frequency distribution for fish collected above Horsetheif Cr.

Figure 86 shows the length frequency distribution for fish collected on Bear Creek 2 mi. above Antelope Pass Rd. Multiple age classes of brook trout were collected.

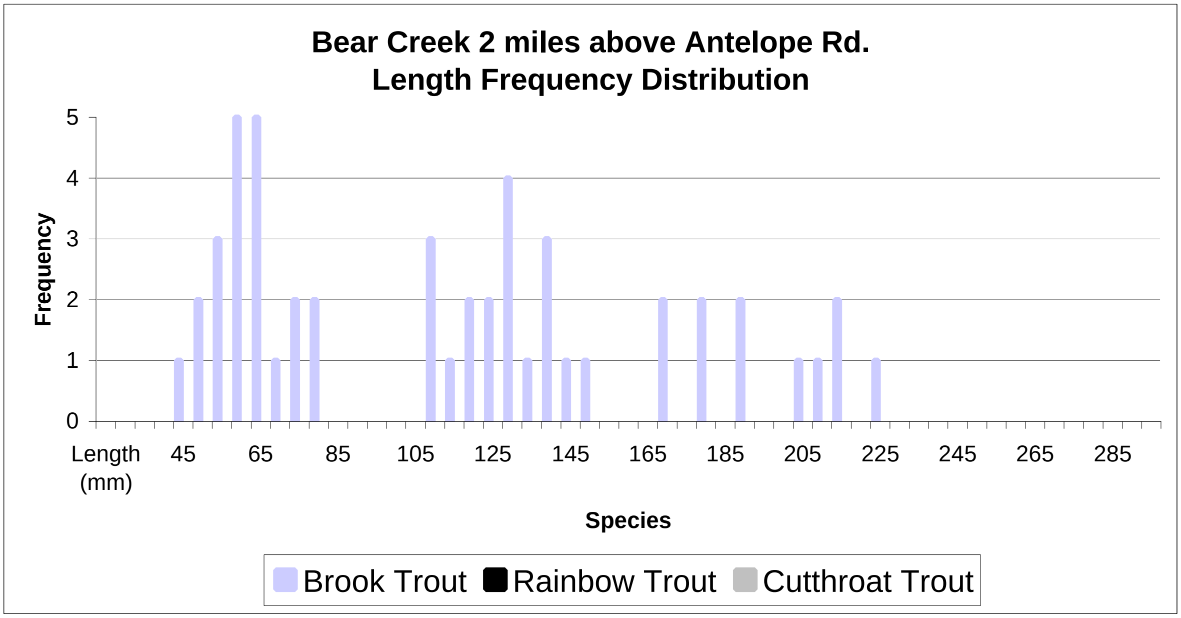

Figure 86. Bear Creek length Frequency distribution for fish collected 2 mi. above Antelope Rd.

Figure 87 shows the length frequency distribution for fish collected on Bear Creek 1.1 mi. above Antelope Pass Rd. Multiple age classes of brook trout were collected.

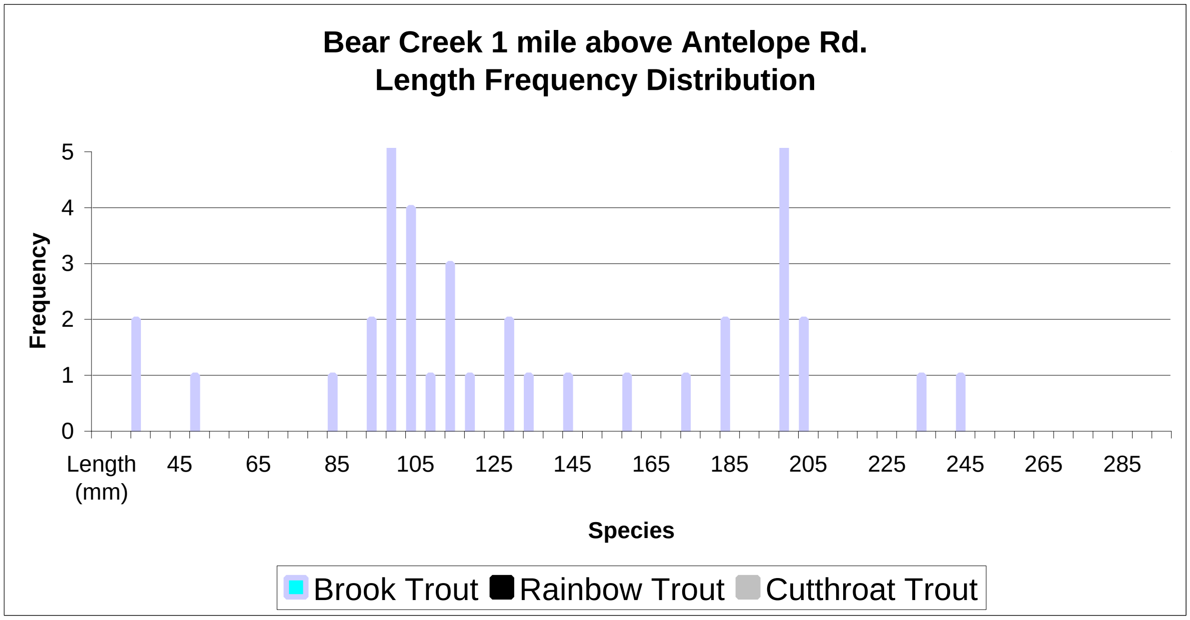

Figure 87. Bear Creek length frequency distribution for fish collected 1 mi. above Antelope Rd.

Beneficial Use Reconnaissance Program Data

Data for streams in the Big Lost River watershed are shown in Appendix F. Assessment data is shown in this section in Tables 46 through 54 for streams appearing on the 1998 303(d) list, and/or for which a TMDL is prepared in this document for temperature criteria exceedence and for which there is BURP data assessed under the current guidance. BURP sites not assessed show scores under the previous assessment guidance system (MBI, HI). Streams previously listed on the 1998 303(d) list were evaluated according to The 1996 *Water Body Assessment Guidance* (DEQ 1996). In this document streams were assessed according to guidelines in The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) (WBAGII) to determine coldwater aquatic life and salmonid spawning support status.

Assessment based on the WBAGII utilizes indexes to evaluate support status of streams. The Stream Macroinvertebrate Index (SMI), Stream Fish Index (SFI) and Stream Habitat Index (SHI) are evaluated using BURP—compatible data. The SMI is a direct biological measure of cold water aquatic life. The scoring criteria are derived from percentile categories of the reference condition. Reference condition is based on a number of sites that are considered minimally disturbed for a particular bioregion (Grafe et al. 2002).

The breakpoints for the SMI are a condition rating of 1 assigned to streams with an index score of less than the 10^{th} percentile of the reference condition, but greater than the minimum of reference condition. Streams with a condition rating between the 10^{th} and 25^{th} percentile of reference condition receive a score of 2, and a score of 3 is given to streams scoring above the

25th percentile of the reference condition. The minimum of reference condition is less than the minimum threshold, a condition rating that identifies significant impairment. DEQ uses this as a signal from individual indexes to ensure protection of cold water aquatic life. DEQ concludes not fully supporting beneficial coldwater aquatic life uses if a water body has even one index result below a minimum threshold.

The breakpoints for the SFI are a condition rating of 1 assigned to streams with an index core of less than the 5th percentile to the 25th percentile. Streams with a condition rating between the 25th percentile and the median of the reference condition for fish populations receive a score of 2, and a score of 3 is given to streams scoring above the median percentile of the reference condition. The minimum of reference condition is less than the minimum threshold, a condition rating less than the 5th percentile that identifies significant impairment.

The SHI scoring system is based on similar concepts used for the SMI and SFI indexes, however DEQ does not use a minimum threshold for this index. This is because there is significant variability among physical habitat measures, and non—biological components are not a direct measure of the aquatic life use.

The breakpoints for the SHI are a condition rating of 1 assigned to streams with an index score of less than the 10th percentile of the reference condition. Streams with a condition rating between the 10th and 25th percentile of reference condition receive a score of 2, and a score of 3 is given to streams scoring above the 25th percentile of the reference condition.

Table 46. East Fork Big Lost River BURP Data.

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
300 m above N. Fk. Big Lost River		N/A	N/A	Too High to Sample	8/1/95
1.75 mi. above Wildhorse		N/A	N/A	56.4	8/14/01
At Confluence of Starhope		N/A	N/A	Too High to Sample	7/31/95
400 m above Corral Cr.	039_03	1	1	33.26	7/3/95
1 mi. above Smelter Canyon Cr.	039_02	0	3	49.08	7/5/95

Table 47. Little Boone Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	Habitat Score	Flow (cfs)	Date Sampled
1 m above E. Fk. Rd.	N/A	N/A	N/A	.043	8/13/01
0.4 mi above E.Fk. Rd.	N/A	0	1	0.44	7/17/96

Table 48. Wild Horse Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	HBI Score	Flow (cfs)	Date Sampled
Left Fork above confluence	031_02	1	1	1.5	9/11/96
100 m above Fall Cr. Bridge	031_02	1	1	23.7	7/13/94
100 m above Fall Cr. Bridge		N/A	N/A	15.35	8/14/01
0.25 mi below forks	031_02	2	1	14.8	7/13/94

Table 49. North Fork Big Lost River BURP Data.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
0.25 mi below Hunter Cr.	027_02	3	2	2.3	9/10/96
0.25 mi above Hunter Cr.	027_02	4.41 (MBI)	112 (HI)	4.7	9/10/96

Table 50. Summit Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
100 m above Park Creek Rd.	028_02	3	1	2.2	9/6/96
100 m above Big Fall Cr.	028_03	3	1	6.2	9/6/96
0.2 mi. below Phi Kappa Cr.		N/A	N/A	4.7	8/7/01
0.25 mi above Kane Cr.	028_03	3	1	7.9	9/10/96

Table 51. Twin Bridges Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
Just below middle tributary	026_03	0	1	30.74	6/21/95
At Trail Cr. Rd.		N/A	N/A	No Flow	8/20/01
At Trail Cr. Rd.	026_03	0	1	47.2	6/21/95
At Trail Cr. Rd.	026_03	2	1	0.37	7/14/94

Table 52. Antelope Creek BURP Data: 7/18 sample listed as Cherry Cr. actually Antelope Creek.

BURP Site Location	Assessment	SMI Score	SHI Score	Flow	Date Sampled
0.5 mi. below Iron Bog Cr.	052_04	3	1	13.57	7/11/94
1 mi. below Cherry Cr.		4.11 (MBI)	60 (HI)	7.90	7/18/94
At Hwy. 93				Dry	8/15/01
100 m below Hwy. 93				Dry	7/18/94
At Hwy. 93	Intermittent	3.45(MBI)	56 (HI)	33.73	7/20/95

Table 53. Bear Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
At Forks	053_03	3	3	15.3	7/2/97
1 mi. below Forks	053_03	3	3	11.73	7/10/96
2 mi. above Antelope Cr.	053_03	3	1	14.6	7/10/96
Right Fork 25 m above 2nd Rd xing	053_02	3	1	14.6	7/10/96
Middle Fork 300 m above confluence	053_02	3	3	11.9	7/11/96

Table 54. Cherry Creek BURP Data.

BURP Site Location	Assessment Unit	SMI Score	SHI Score	Flow	Date Sampled
L.Fk Cherry, 3mi. above Cherry Cr.	051_02	3	1	4.93	7/11/94
0.75 mi. above Richardson Canyon	050_04	1	1	0.08	7/11/94

Status of Beneficial Uses

Big Lost River Subbasin Above Chilly Buttes

The data presented in the previous section indicates that, on 303(d) listed streams, where flow is perennial, beneficial uses for salmonid spawning are supported (see Figures 76 through 86 above). Multiple year classes including young of the year were collected on listed reaches.

Coldwater aquatic life support status is determined by assessment of BURP data. Data from BURP sites is not conclusive in-and-of itself, but generally indicates support of coldwater aquatic life (Tables 46 through 54). BURP sites on the East Fork and North Fork of the Big Lost River are clustered around headwaters reaches. Large river assessments have not been conducted on the lower East Fork, lower North Fork, or the Big Lost River above Chilly Buttes.

This is partly because of accessibility for BURP data collection crews and partly because flow at lower sections (between the Forks and Chilly Buttes) were elevated at the time that wadable stream samples were being collected. There is no DEQ BURP data for the Big Lost River in sections that are not flow altered. This is also related to flow volume at lower sections that can be accessed and assessed because flow is diminished at times. Access to optimal sample locations is also limited by private property. The problem is often that after stream flow is diminished so the stream can be reasonably sampled flow disappears for significant periods of time. Segments that are usually dry do not assess very well with regard to cold water aquatic life. The hydrology and land use on upper watershed streams are similar and water quality conditions are similar where there is flow. Coldwater aquatic life is generally supported were there is perennial flow.

Streams that are ephemeral are required to meet numeric water quality criteria during the periods of optimal flow. The periods of flow are strongly correlated with snowmelt runoff and numeric water quality criteria that are most applicable are temperature standards. During runoff conditions cold water temperature standards on ephemeral and perennial streams are generally met.

After peak runoff, and in some cases before peak runoff, however, many of the mainstem waters become warm in excess of water quality criteria for spring and fall spawning. This does not necessarily preclude beneficial use support, particularly if fish are able to migrate into thermal refuge during warm water periods of the year. Fish have evolved under these conditions of variable temperature regimes in nature. However, Perennial streams are required to meet numeric water quality standards without regard to beneficial use support status.
Water temperature becomes a greater problem when fish migration to thermal refuge is blocked due to dry channels and obstacles to fish migration such as culverts, irrigation diversion structures and thermal barriers. Fish migration conditions are good within mainstem sections of the Big Lost River above Chilly Buttes to the East Fork and North Fork of the Big Lost Rivers. Within the East Fork and North Forks of the Big Lost River migration conditions are good to upper sections of the streams. Bridges are used instead of culverts on the mainstem waters to upper reaches where culverts are in use. Culvert barriers on tributaries have not been documented by land management agencies, however none were observed during field work related to this report on other than ephemeral streams.

Areas that fish would use as thermal refuge in upper watersheds warm beyond water quality standards, but not beyond the range of tolerance of fish. This is evidenced by the fact that no streams have major exceedence of aquatic coldwater aquatic life temperature criteria, but exceedence of salmonid spawning criteria are widespread throughout streams where monitoring has been conducted (Tables 10 through 31). The exceedence is generally limited to the fringe of spawning periods though. Exceedence of salmonid spawning criteria is generally clustered around the end of June and the middle of September. Again, fish are able to migrate to cooler waters where conditions often favor spawning, and fish are able to shift their spawning periods locally to take advantage of optimal conditions, where optimal conditions exist. Herein can be the problem when headwater streams are not optimally managed.

Streambank stability is diminished over much of the East Fork and North Fork of the Big Lost Rivers (Tables 41 through 45). This results in increased stream width and a reduction of riparian vegetation vigor and diversity at the streambank to shade the stream and prevent further erosion. Hill slope erosion is not considered to be above natural background levels here, and road sediment inputs are isolated. As riparian conditions are continually degraded at the streams edge streambank erosion is accelerated. This results in further widening of the stream and a reduction of shading which results in greater thermal inputs to the stream which results in increasing stream temperature throughout the day and throughout the season. Materials incorporated into streambanks, such as cobble and fine sediment enter the stream and fill instream habitat features and interstitial spaces important in spawning gravel and displacing aquatic insects. Left unchecked, by adaptive management, water quality is impacted. This is evidenced in the temperature data exhibited in this report during spring and fall spawning seasons.

The only other listed tributary stream above Chilly Buttes is Twin Bridges Creek. There is fish data to indicate that salmonid spawning is likely supported above the dewatered reach, however macroinvertebrate scores are low. Cold water aquatic life is not likely supported due to sediment loading from failing streambanks and elevated stream temperature.

Big Lost River Subbasin: Chilly Buttes to Mackay Dam

The lack of flow in the Big Lost River from Chilly Buttes to the Mackay Reservoir occurs naturally, however it is exacerbated by past and present human activity. Diversion of water for irrigation is based on water rights and is not subject to the Clean Water Act. Activities related to diversion of water for irrigation, such as maintaining diversion structures and ditches and streambed alteration to aid diversion of surface water are governed under laws administered by the Army Corps of Engineers and the Idaho Department of Water Resources. Flow alteration is not a pollutant that is recognized for development of TMDLs and the effect of flow alteration on beneficial use support is not subject to developing a load allocation to restore beneficial uses. It is not likely that beneficial uses for cold water aquatic life or salmonid spawning in the Big Lost River would be fully supported in the absence of surface diversion of irrigation water due to the natural dewatering of the stream channel. Dewatering of the stream channel from Chilly Butte to Mackay Reservoir occurs with enough frequency and duration to preclude restoration of beneficial uses. Flow duration and frequency must be adequate to sustain riparian vegetation and the natural pattern and profile of the stream.

Flow characteristics places particular importance on aquatic systems that do have the potential to support beneficial uses that are perennially connected to the Big Lost River channel. These systems become refuge for fish and aquatic life when there is no flow in the Big Lost River so that during periods of sustained flow recolonization may occur within the channel. Thousand Springs Creek, Warm Springs Creek and Mackay Reservoir are the only identifiable systems above the perennial segment of the Big Lost River (from Mackay Dam to the Moore Diversion) that provide refuge for aquatic organisms and fisheries.

There are no BURP sites on Thousand Springs Creek to show status of coldwater aquatic life support, nor are there fish data to show that this water is in full support of salmonid spawning. There is data to show that Chilly Slough has good populations of brook trout and it can be inferred that there is adequate spawning habitat to support the population there. Thousand Springs Creek, however is a discrete body of water below Chilly Slough. Riparian conditions on Thousand Springs Creek are severely degraded by grazing practices. The Idaho State University data shows that the substrate is composed of 100% silt size fines at their sample location, and cobble imbededness is 100%. The riparian community below Trail Creek Road is composed primarily of grass species. The Thousand Springs macroinvertebrate community is characteristic of outlet flow from a wetland. Given this condition coldwater aquatic life beneficial uses are likely supported at the level of their potential and Thousand Springs Creek functions as a migratory pathway to overwintering habitat and thermal refuge in Chilly Slough. Salmonid spawning however is not fully supported in Thousand Springs Creek from the Big Lost River to Chilly Slough due to streambank erosion and temperature loading related to loss of riparian vegetation.

Warm Springs Creek supports a wild population of kokanee salmon found in Mackay Reservoir by providing spawning habitat and rearing habitat. The Department of Fish and Game no longer stock these fish into Mackay Reservoir, however they are an important component of the Mackay Reservoir fishery. There are good populations of rainbow trout and kokanee salmon in lower Warm Springs Creek based on personal observation and anecdotal information. The upper segment of the stream hosts two fish hatcheries that are a source of fish to the system as well. Salmonid Spawning is supported within Warm Springs Creek though cold water aquatic life may be impaired throughout Warm Springs Creek's course as evidenced by macroinvertebrate data from the only BURP monitoring site near the headwaters. Temperature loading exceeds water quality criteria for salmonid spawning during spring and fall spawning periods as well.

Big Lost River: Mackay Dam to Moore Diversion

Beneficial uses for salmonid spawning and coldwater aquatic life through this reach are likely supported. Mackay Reservoir buffers this lower reach from the effects of natural and anthropogenic dewatering during the period when the river is dry above the dam. Irrigation release moderates stream temperature and the reservoir, to a certain degree, reduces sediment inputs to this segment of the river. The fishery below Mackay Dam is regionally very popular and is self-sustaining. Fish are present throughout the reach despite the abundance of unscreened diversion structures and progressively degraded instream habitat due to diminishing flow downstream. BURP sites are also absent along this reach due to constraints of access and flow, however Idaho State University data points toward beneficial use support that becomes marginal downstream due to flow issues. Below the Moore Diversion flow alteration precludes support of beneficial uses.

Antelope Creek

Antelope Creek is ephemeral below the South Fork of Antelope Creek Diversion. Based on fish and macroinvertebrate data it likely fully supports salmonid spawning and coldwater aquatic life above the confluence of Spring Creek. The 1994 BURP site listed for lower Cherry Creek is actually on a split channel of Antelope Creek just above Spring Creek and this site shows strong full support for coldwater aquatic life. Below the Antelope Creek Road crossing, below Cherry Creek, however riparian habitat is severely degraded with severe erosion and impacted substrate.

This reach is primarily on private land but receives flow throughout the year to the diversion. Hillslope erosion is considered within natural background. Road sediment inputs are isolated and do not compare with loading from streambank erosion.

Moore Diversion to the Sinks

The lower watershed lacks connectivity and adequate flow in tributaries to support beneficial uses in the mainstem Big Lost River. Tributaries will remain isolated to other than introduced species of fish. The unique aquatic system of the Playas and Sinks is at the mercy of natural conditions and agricultural flow management.

Conclusions

Water Quality Limited Segments

Load allocations will be developed for the East Fork of the Big Lost River, and its major tributaries; Corral Creek, Starhope Creek and Wildhorse Creek to address exceedence of water quality standards for temperature. The load allocation will include sediment because the mechanism by which stream temperature is increasing is strongly related to streambank erosion and the resulting changes in channel morphometry. The load allocation for temperature will apply to all waters in the watershed.

The North Fork of the Big Lost River will receive a load allocation for temperature and sediment as well because the same mechanisms effecting the East Fork of the Big Lost River are at play in this watershed. There is no evidence that a nutrient load allocation is required for the upper subbasin at this time because deleterious levels of aquatic growth have not been observed and receiving waters do not appear to be nutrient impaired. Reducing sediment will further buffer nutrient issues, however.

The Big Lost River from the confluence of the North Fork and the East Fork to Chilly Buttes will receive a load allocation for temperature. Reduction of sediment loads in the upper watershed will reduce nutrients and sediment to this reach of river as well. Twin Bridges Creek will receive a gross allocation for sediment and temperature to address the lack of support for beneficial uses. The load allocation for Twin Bridges Creek will be directed at segments with perennial flow that will ultimately extend flow to the current ephemeral segment below private land.

Warm Springs Creek will receive a load allocation for temperature and the discharge from the two hatcheries on Warm Springs Creek and Whiskey Creek will receive Waste Load Allocations to eliminate deleterious discharge of fish waste into Warm Springs Creek that limits beneficial use support throughout the streams coarse.
Antelope Creek and its major tributaries Bear Creek and Cherry Creek will receive load allocations for temperature. Antelope Creek will receive a load allocation for sediment from the confluence of Bear Creek to the South Fork of Antelope Creek Diversion.

The time periods for critical flow are related to the times when erosion is highest, particularly during snowmelt at bankfull conditions. Raw streambanks, however, can also be exacerbated during periods of ice build up during winter months. Ice buildup has been noted on Antelope Creek below Cherry Creek and on the East Fork Big Lost River below Starhope Creek and the North Fork Big Lost River below Chicken Creek. Ice damming increases as streams loose riparian cover and width to depth ratios increase from excessive streambank erosion. Streams radiate heat to the sky, instead of riparian vegetation, a well known thermodynamic principal of streams. Water becomes super-cool, below the freezing point, and ice forms in the channel backing up flow. This causes abrasion of streambanks and when the ice dam releases scouring can take place causing further erosion.

The time periods of critical temperature exceedence are of moderate duration, during spring and fall spawning periods, however the magnitude of exceedence is variable as a function of climate and streambank erosion manifested by width and depth and riparian cover.

Since most streams support salmonid spawning and coldwater aquatic life the key indicator for temperature standard compliance will be stream temperatures monitored above confluence points. These points will become points of compliance for monitoring in the future.

Starhope and Wildhorse Creek will have to be within temperature criteria above the point of confluence with the East Fork. The East Fork and North Fork will have to be within temperature criteria above the point of confluence. The Big Lost River will have to be within criteria above Chilly Buttes. Twin Bridges will have to be within criteria at the private/BLM boundary, or the lowest point of flow greater than 1cfs.

Antelope Creek will have to be within criteria to the South Fork Antelope Creek Diversion. Bear Creek and Cherry Creek will have to be within criteria above Antelope Creek. Key indicators of sediment impairment on Antelope Creek will be reflected in beneficial use support for cold water aquatic life and salmonid spawning as outlined in Water Body Assessment Guidance (DEQ 2002).

The Big Lost River below the Moore Diversion is impacted by flow alteration. The Big Lost River from Chilly Buttes to Mackay Reservoir is also impacted by flow alteration. Antelope Creek from the South Fork Antelope Creek Diversion to the confluence with the Big Lost River is impacted by natural and anthropogenic flow alteration as well. Spring Creek, that begins at the Moore Diversion, is an overflow channel to a natural stream channel that seldom sees flow in enough quantity or duration to support beneficial uses for aquatic life. Parsons Creek, also an overflow channel, has some seasonal channel recharge from ground water and periodically has flow during runoff, but not of enough duration or quantity to support aquatic life beneficial uses above the level required to show full support. Few of the streams that evolve from the Lost River Range, or the eastern front of the White Knob range actually flow to a confluence with the Big Lost River. The cause of flow alteration is a combination of natural causes and human management. These streams will not have load allocations prepared or minimum flows recommended.

2.4 Data Gaps

There is adequate data to determine temperature criteria exceedence at existing monitoring points in the Big Lost River. There is adequate data to show that flow alteration exists below critical zones of infiltration on the Big Lost River and Antelope Creek. There is adequate data to show that beneficial uses for salmonid spawning and cold water aquatic life are supported where perennial flow is found on public land. What is not known with adequate resolution is beneficial use support status at key locations on privately managed lands. Access for monitoring has been an obstacle to more accurately determining beneficial use support at specific locations over time. As long as beneficial use support drives water quality status it will be important to gain access to private segments of land.

There are important data gaps with regard to water quality status, pollution loading, and beneficial use support status on private land. There are a number of agencies that assist with private land management issues. Many of the services that agricultural management agencies offer can be related to improving water quality on private land. Few services are related to assessing water quality or aquatic life. Some agencies provide very basic qualitative characterization of riparian vegetation and channel condition. This data is often of limited value to meeting the quantitative needs of water body assessment to determine beneficial use support status or the compliance with water quality standards. This does not prevent inferential determination of support status and application of gross allocations of pollutants to restore beneficial uses, or to ultimately show that beneficial uses are in fact supported where there has not been data. If stronger relationships between beneficial use support status and pollution loading are going to be established monitoring on private land must be achieved by agencies affiliated with that management and that data has to be made available for evaluation.

Given the rich mining history of the Big Lost River watershed it can be assumed that there could be numerous environmental liabilities with regard to mine tailings, mill sites and waste rock. Water quality monitoring for metals contamination has been limited within the watershed. Evaluation of known concentrations of mining activity have not identified areas with obvious potential for impacts to water quality related to human health or aquatic life. Sampling resources must be allocated to address known issues first. Limited water quality monitoring has not shown chronic or acute exceedence of water quality criteria for substances related to mining. Monitoring should continue though no particular issues have been identified.

The impact of riparian grazing on water quality has been well documented. Methodologies for monitoring of riparian condition are well established and should be implemented by land management agencies. The data that accrues from monitoring must be utilized to guide management of riparian areas to protect water quality. Priority must be given to assess conditions and manage accordingly to enhance water quality where needed and to protect existing water quality. Monitoring must be quantitative and periodic to be of value to track changes over time.